NASA CONTRACTOR REPORT 166453

Planning for Rotorcraft and Commuter Air Transportation

Willard L. Stockwell, et al
Dr. Joseph Stowers, et al

CONTRACT NAS2– 10815
August 1981

NASA

NASA CONTRACTOR REPORT 166453

Planning for Rotorcraft and Commuter Air Transportation

Willard L. Stockwell, et al
American Planning Association
Transportation Planning Division
c/o MAPD
City Hall - 10th Floor
455 N. Main Street
Wichita, KS 67202

Dr. Joseph Stowers, et al
System Design Concepts, Inc.
1643 I Street, N.W.
Suite 200
Washington, D.C. 20006

Prepared for
Ames Research Center
under Contract NAS2-10815

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

This study has been conducted by System Design Concepts, Inc. (Sydec) as a subcontractor to the Transportation Planning Division of the American Planning Association (APA). The report is a major input to the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation. A complementary study on rotorcraft technology has been prepared by the Helicopter Association International and Vitro Laboratories, Inc. Both studies were performed under contract to the National Aeronautics and Space Administration (NASA), Ames Research Center.

The Monterey Conference is being jointly sponsored by the Transportation Planning Division of APA and NASA to facilitate a dialog among planners, local officials, manufacturers, operators and other technologists, on planning for rotorcraft and commuter aviation. The Conference and the publications to result from it are intended to aid the larger national constituencies in all these fields in advancing the state-of-the-art for planning, in furthering the development of responsive technology, and in facilitating the development of an improved, integrated air/ground transportation system in communities throughout the country.

The Co-Chairmen of the Conference are Jay Christensen of NASA-Ames and Willard Stockwell, the Chairman of the Transportation Planning Division of APA. Mr. Stockwell is also the contract manager of this study for APA. Both Conference Co-Chairmen provided continuing valuable guidance throughout the study.

A major portion of the study has been a survey of transportation planners involved in short-haul aviation in a cross-section of communities throughout the country. This work has been conducted by Dr. Martin Huss of Sydec. In the course of conducting this survey, Dr. Huss assembled a great deal of recent technical materials on this subject and has used this material in providing drafts for various portions of this

report. Mr. Ronald Bixby of Sydec has performed a survey of regulatory policies and ordinances for a representative cross-section of communities, and has prepared the chapter assessing "Legal and Regulatory Requirements." Mr. Bixby has also been responsible for drafting and editing other parts of the report. Dr. Joseph R. Stowers, Vice President of Sydec, has been responsible for overall study management, editing of the report and coordination with other activities related to the Monterey Conference.

The study team wishes to thank all of those who participated in the survey (see Appendix C) and those who provided valuable advise and materials. Many hours of volunteer effort by several dozen people have provided us with a valuable benchmark in assessing the state-of-the-art in this emerging and challenging field. The authors, of course, assume responsibility for the product, and invite suggestions and criticisms.

EXECUTIVE SUMMARY

Introduction and Planning Context

The purpose of this study is to identify community planning needs, criteria and other considerations such as intermodal coordination and regulatory requirements, for rotorcraft and fixed wing commuter air transportation. The results of this study and the consensus of the Monterey Conference are intended to provide a broad range of community planning guidelines, issues and information which can be used to:

- Direct anticipated aircraft technological improvements during the 1980s
- Assist planners in identifying and evaluating the opportunities and tradeoffs presented by rotorcraft and commuter aircraft options relative to other modes
- Increase communication between aircraft technologists and planners for the purpose of on-going support in capitalizing on rotorcraft and commuter air opportunities

The primary tool for identifying and analyzing planning requirements was a detailed questionnaire administered to a selected sample of 55 community planners and others involved in planning for helicopters and commuter aviation. Secondary information sources included planning documents, available literature, local ordinances, supplemental phone contacts, and the results of the rotorcraft and fixed wing commuter air transportation workshop conducted at the national APA conference in Boston, April 27, 1981.

Nature of the Problem

Despite temporary energy shortages and higher fuel prices, intercity air transportation is expected to continue its steady growth over the next several decades, increasing its share of passenger travel relative

to other modes. Rotorcraft and fixed wing commuter air services are expected to make a significant contribution to this growth. The reasons are varied. Major technological advances are expected, new public service and private markets are developing rapidly and travel patterns are changing especially in response to the value of time, where helicopters and commuter air services offer distinct competitive advantages.

At the same time airport and ground access facilities are nearing capacity in some areas of the country, and are underutilized in others as the result of deregulation. Conventional solutions to these problems (i.e., build more airports, expand existing airports, provide subsidized scheduled air service), are seriously limited because of economic, environmental, local regulatory and political constraints. Depending on the area (large urban, medium size urban, small urban/rural), rotorcraft and commuter air services and facilities may present alternative solutions.

Community Planning Roles and Responsibilities

Most planners are informed about rotorcraft and fixed wing commuter air transportation benefits and opportunities to the extent that they have a "need to know." That is, planners employed by airport authorities, state or county aeronautics departments have considerable expertise, while those who work for metropolitan planning organizations (MPOs) and city or county planning departments focus on ground transportation modes, and are only peripherally and occasionally involved in air mode problems and issues, principally land use, congestion and noise control planning near existing airports.

As a result, planning roles and responsibilities for investigating the opportunities and evaluating the liabilities presented by rotorcraft and fixed wing commuter aircraft are not well defined. The subject is not taught in planning schools and relatively few consultants are

involved. Few widely recognized guidelines and technical criteria for these modes are available to community planners. Alternatively, few lines of communication exist among community planners, technologists and the aircraft industry to interpret changing local air travel needs, develop planning guidelines, and direct technological development priorities.

Conclusions and Recommendations Regarding Planning Needs

A clear need exists for rotorcraft and fixed wing commuter aircraft planning information, and communication between community planners and aircraft technologists.

First, information suitable for use in transportation planning curricula, by consultants, airport operators, public agency planners, and public officials should be developed. The study team recommends that NASA, in cooperation with CAAA, APA, HAI and others, develop a technical manual designed for reference in the following types of planning activities:

- Develop and evaluate ground/air transportation system alternatives, where rotorcraft and fixed wing commuter air options have traditionally been neglected
- Plan and develop new facilities, such as heliports, which have been difficult to establish in the past in most areas
- Determine the need and appropriateness of local laws and regulations, such as zoning and helicopter ordinances
- Develop and coordinate a ground/air transportation planning process at the local level, and achieve better integration among different modes

Second, no established communication mechanisms exist between those responsible for rotorcraft and fixed wing commuter air transportation planning, and technologists responsible for aircraft development. NASA, APA, HAI, CAAA and other interested groups should cooperate in setting up a permanent mechanisim to promote communication and to carry on activities to facilitate planning for rotorcraft and commuter aviation.

Survey of Planning Needs and Criteria

The Survey of Transportation Planners and Consultants was designed to provide information on planners' and consultants' perspectives on community rotorcraft and commuter air planning. It dealt with such issues as what assessment criteria and parameters are important, and where further research is necessary, as perceived by planners in various levels of government, consulting firms and universities. These assessment criteria and parameters pertain to:

- Transportation planning data needs
- Marketing and economic analysis
- Facilities and operations planning
- Environmental and safety issues
- Potential impacts on communities' industrial base
- Existing transportation systems
- Quality of life

The survey sample consists of fifty-five respondents from all over the country, and from various types of agencies and levels of responsibility. The results of the survey are summarized in the next few pages.

Transportation Missions

The table below presents eight transportation missions and an indication of their importance in terms of planners' perception of their current (1980) and future ranking (1990):

	Rotorcraft		Fixed Wing Commuter	
	1980 Rank	1990 Rank	1980 Rank	1990 Rank
Public Transportation (CBD-CBD, CBD-airport, airport-airport, other)	6	5	2	1
Public Service (police,fire,rescue, etc.)	1	1	6	4
Business/Corporate	2	2	1	1
Cargo, Goods Movement	7	7	3	2
Construction	3	3	8	6
Energy Exploration	4	4	4	3
Forestry	5	6	5	6
Other	7	8	7	5

Important Issues

Respondents were asked to rate each survey question issue in terms of importance relative to the type of planning in which they are currently engaged. The table below shows the 14 highest rated issues out of a total of 46:

Topic	Relative Importance	Mean Rating
Airport/Heliport location	1	1.8
Planning data	2	1.7
Adequacy of planning data	3	1.5

(table continued on next page)

Transportation Service Factors	3	1.5
Noise measurement parameters	3	1.5
Far-field noise	3	1.5
Environmental Impact	4	1.4
Vehicle Performance	4	1.4
Legal/Regulatory data	5	1.3
Defining markets	5	1.3
Ground access	5	1.3
Community intrusion	5	1.3
Air traffic congestion	6	1.2
Safety statistics	7	1.0

Summary of Responses by Planning Assessment Category

This section summarizes the results of all 46 survey questions according to five planning assessment categories: Economic, Safety, Community Quality of Life, Limited Fuel Environment, Interfacing with Other Modes, and Other Assessment Parameters.

Economic

The economic issues which are of importance to planners are those which affect the competitiveness of rotorcraft and commuter air with other modes. A prime concern of planners is the instability of service. With deregulation, some commuter airlines have come into being without the proper financial backing and/or without a realistic forecast of what their operating and indirect costs would be (fuel consumption, maintenance, insurance, etc.). Many new services quickly go out of business, making the public more reluctant to rely on such services. And, since businesses, as well as individuals, make locational choices partly based on transportation, it is very disruptive when new services are unreliable and unstable. Thus, planners who are involved with trying to establish air transportation service in their communities are concerned with economic viability.

In terms of economic effects on the community, planners feel that there are several areas in which better air transportation can be beneficial. The provision of connections among CBDs, between CBD and outlying airports, linking small communities which are currently without good inter-community transportation, tying smaller communities into hub airport and commercial airlines, are all important benefits. Planners are aware of the inducement to new industry provided by good accessibility to air transportation. Linking central city management with outlying plants and facilities by rotorcraft, providing efficient, quick transportation among various locations of a particular industry (which may be spread over several states), and the ability to transport employees, parts and equipment from site to site, are all benefits which strengthen a community's or region's economic base.

Safety

Safety is among the top fourteen issues rated by respondents to the survey. Planners are in need of hard statistics to compare rotorcraft and commuter air safety to other modes, such as accidents and fatality rates per passenger-mile. The over-riding concern is the public's perception of instability of small aircraft, which leads to public resistance to use rotorcraft. Planners also sense that the media's pre-disposition to sensationalize air crashes has helped foster an image of danger, and consequently public officials are reluctant to speak out in favor of small aircraft operations.

Community Quality of Life

Planners are in agreement that rotorcraft have helped in improving the quality of life, in several important ways. Primarily, the use of rotorcraft in emergencies for evacuating fire, accident or disaster victims, from rooftops, flooded areas, etc., has been impressive. Quantifying this role is difficult, although some measure of improved response time, or lives saved per dollar of rescue effort is possible. The same is true for increased police protection.

An important issue brought out by planners is the need to develop a benefit/cost analysis technique which can assess and evaluate these various factors. A planner should be able to assess air transportation systems options fully including due attention to effects on environment and quality of life.

Limited Fuel Environment

Planners feel that they do not have enough information on fuel consumption rates for rotorcraft and commuter aircraft to be able to compare them to other aircraft and to ground transportation. However, these data do exist, and planners should be made more aware of the stage lengths and fuel consumption rates of the latest rotorcraft and commuter aircraft. This is an area where manufacturers and operators can work together with planners to everyone's mutual benefit.

Planners show uncertainty in terms of what missions could potentially reduce fuel consumption compared to other modes. There is some feeling that in specialized activities, such as construction, or providing access to off-shore drilling operations, rotorcraft might be cost-effective from a fuel-use point of view.

Interfacing With Other Modes

As has been described, the ability to connect smaller cities with commercial flights at hub airports in large cities, and to provide access from central city transportation (taxis, local transit, intercity rail and bus, and even water transportation) to airports via STOL or rotorcraft is an important benefit. This was highlighted by the fact that respondents select "inter-modal connections" as the most important service factor for rotorcraft and second most important factor for commuter air.

Providing for convenient transferring among modes is an important factor in creating an overall integrated ground/air transportation system. Coordination of schedules, through-handling of baggage and ticketing of connecting modes, and properly designed terminal facilities will all attract increased ridership.

Other Assessment Parameters

Comfort and amenities aboard rotorcraft and commuter aircraft is another subject of interest to planners from the perspective of their effect on ridership and public acceptance. Reliability in various weather conditions and the problem of vibration in rotorcraft are the most frequently mentioned concerns in this category. Lack of roominess and seating comfort is the second most important concern for rotorcraft, and the most important for commuter aircraft. Pressurized and climate-controlled cabins are also quite important.

The same is true for commuter aircraft, and longer trips make increased comfort more of a necessity. Additionally, as the commuter airlines are providing connections to trunk airlines less of a contrast in comfort level between the commuter vehicle and the commercial aircraft would help to generate ridership. Furthermore, enhancing the image of smaller aircraft as "sexy compacts," which the automotive industry has done successfully in the changeover to smaller cars, would be an excellent marketing strategy.

Conclusions and Recommendations Resulting from Survey

For rotorcraft, planners are beginning to realize the potential public transportation roles which these vehicles can fulfill. With more knowledge of state-of-the-art rotorcraft and STOL technology, including such issues as safety and all-weather capability, ridability and comfort, fuel consumption and operating costs, planners would be able to determine

appropriate market situations where rotorcraft and STOL could become economically viable transportation systems. Furthermore, planners could help educate the public as well as elected officials who constitute the critical lobbying and decision-making groups who will determine the future of rotorcraft and STOL in public transportation.

The commuter airline industry is in a situation where technology is beginning to respond to demand by producing a new generation of small aircraft capable of efficiently serving lower desity shorter haul markets. With deregulation, some cities have been left with lesser, or without any service, and have become isolated from one another and from hub cities. Other cities have been more fortunate in having achieved more frequent service, and more connections to other locations, as new commuter airlines have seized the opportunity to tap a relatively virgin market. The primary issue here is for planners to be equipped with the market analysis and forecasting techniques, as well as the economic and operating data on the state-of-the-art of commuter air technology, so as to be able to help plan, gain support for, and implement, an efficient, comprehensive network of commuter air routes.

Planners will have to work together with researchers, manufacturers and operators, as well as public groups and local, state and Federal officials, in order to accomplish these objectives. The following is a summary of planners' most frequently mentioned recommendations and comments ranked by frequency of comment:

For Researchers:

Number of Comments	
13	Determine markets for rotorcraft and commuter air; locate transportation-isolated communities in need of air service
13	Improve ride quality and amenities, pressurized cabins, reduce noise (in-vehicle and far-field), study rotor wash impacts, improve noise modeling, and develop standards for noise and community intrusion

7 Develop methodologies for quantifying costs, benefits and economic impacts on the community for rotorcraft and commuter air services, and for quantifying relationships between transportation accessibility (air and ground) and industrial growth

7 Improve fuel efficiency, use alternative fuels, and provide needed information on fuel consumption and operating costs

6 Improve safety, weather reliability, instrument guidance (micro-wave landing systems for commuter aircraft, instrument approaches to heliports, etc.)

For Manufacturers:

Number of Comments	
16	Reduce noise emissions and rotor slap for rotorcraft
15	Improve fuel efficiency; use of alternative fuels
8	Improve safety: instrument guidance, anti-collision and weather reliability
8	Reduce maintenance costs (especially for rotorcraft) and initial costs

For Operators:

Number of Comments	
9	Educate the public as to safety and benefits to community for rotorcraft and commuter air
7	Use marketing and promotions to enhance image and gain support for new services
7	Apply management techniques to reduce costs, minimize ground support and infrastructure
6	Provide economically sound service, stable fares and ridership; do not rely on subsidies; price what market will bear

Integrated Air and Ground Transportation

This section assesses the requirements for integration of rotorcraft and commuter air transportation modes with one another, with long-haul

air transportation and with ground transportation. A framework for planning to make more efficient use of aircraft and air facilities is presented. Opportunities and benefits of integration of modes are suggested.

The various components of an integrated air system may be stratified as follows:

LOCAL (intraurban)

- CBD to hub airport, and/or outlying commuter or reliever airport
- Airport to airport (within same metropolitan area)
- CBD to outlying industrial parks, office parks
- Suburban site to site (industrial, office, etc.)

INTERURBAN

- Large city (CBD) to small city
- Large city (hub airport) to small city
- City to city (CBD to CBD)
- City to city (hub airport to hub airport)

INTERNATIONAL

- International (port of entry) airport to foreign country

Within an integrated air system, trips originating or ending in a CBD could be made by rotorcraft or possibly STOL. Suburban and short distance trips among airports could be made by rotorcraft, STOL, commuter aircraft or commercial aircraft, depending upon actual distances, passenger volumes, load factors, and operating costs (primarily fuel consumption) of the vehicles. Long haul interurban and international trips would be made by larger commercial aircraft.

One of the prime requisites of an integrated air transportation system is access to the various components. This includes:

- Point of origin of the trip to the initial air mode (by ground transportation)
- Transferring from one air mode to another, if necessary
- Access from final air mode to destination

For transportation systems to work effectively, adequate access, as well as convenient transfer among modes, has to be provided at all facilities.

Planning Framework

Ground transportation not only provides access to air transportation facilities, but also represents a competing mode. For short trips in urban areas, such as from CBD to airport, or among several airports within the same metropolitan area (e.g., Newark, JFK and La Guardia in N.Y.C.) or CBD to suburban office/industrial sites, auto, taxi, limo and public transit all represent competition for rotorcraft. In periods of peak traffic congestion, rotorcraft would have the distinct advantage of time savings, while trip costs may or may not be higher for rotorcraft, depending upon through-ticket discount arrangements with connecting airlines, and other factors. Future advances in rotorcraft technology such as larger, more fuel efficient craft, will help reduce operating costs per passenger mile, and make rotorcraft even more competitive with ground transportation.

The parameters which must be examined in order to analyze each mode relative to other modes, from a cost/benefit perspective, include:

- Speeds, travel times, for each mode and performance characteristics of vehicles
- Productivity and passenger-miles per dollar of operating cost (fuel, wages, seating and load factors of vehicles, maintenance costs, etc.)

- Comfort level (noise, vibrations, amenities)
- Accessibility of modes, door-to-door total travel time, location of facilities relative to users
- Convenience of modal transferring where necessary (ease of transfer, through-ticketing, baggage handling, waiting times, etc.)
- Coordination of schedules among modes
- Geographic constraints to particular modes
- Legal and regulatory issues concerning operations, routing and scheduling
- Economies of operations, revenues and costs, subsidies, capital grants, etc.
- Environmental considerations
- Safety issues

While much of these data are known for other modes, planners may not be aware of some of the needed information for rotorcraft or commuter air. When planners are more familiar with these data and the missions or roles which can best be accomplished by these modes, they will be better equipped to plan a more integrated ground/air transportation system.

Conclusions and Recommendations on Modal Integration

The different levels of air transportation serving different segments of the market, and various air and ground modes providing access and connections, as well as competition, should be unified into an integrated system, much as the highway system provides for local and collector routes tying into arterials, which in turn link Interstate highways. The needs of each type of community and the various market segments must be studied, and the most efficient types of vehicles developed for meeting these needs. Goals should be set which would define the roles air transportation will have in the local, regional and nationwide transportation system. In this way, a clear picture will develop as to the direction which rotorcraft and commuter air planning should take.

Recommendations of the study team include:

- Gather and disseminate pertinent information on rotorcraft and commuter air technology, performance, operating costs, etc.
- Determine which vehicles (existing or proposed) would be most appropriate and cost-effective for the various types of service (missions)
- Study travel patterns of different types of travelers, and the transportation needs of different types of communities, as well as various types of corporate, commercial and industrial activities, to define the various market segments and their transportation requirements
- Study potential benefits of improved integrated ground/air transportation (time savings, economic base, safety, etc.) on various types of communities and businesses, and quality of life
- Perform benefit/cost analyses to determine most beneficial and cost-effective assignment of modes and vehicles for creating an integrated system
- Educate the public and officials (decision-makers) and gain support for implementation (planning, approval, funding) of an integrated system

Legal and Regulatory Requirements

Federal, state and local governments are involved in most types of new helicopter and commuter air facilities, or changes to existing facilities. While the Federal government's roles and responsibilities are clearly defined and limited, the participation of state and local government varies widely, especially concerning heliports.

Federal

The Federal government, through the responsibilities assigned to the Federal Aviation Administrator under the Federal Aviation Act of 1958, controls the following areas of aviation in the United States:

- Airspace use and management
- Air traffic control
- Safety
- Regulation of aircraft noise at its source

The FAA exercises control in these areas by issuing Federal Aviation Regulations (FAR), and Advisory Circulars (AC), which serve as mandatory and voluntary guidelines to states, local governments and the private sector. Through its decisions to fund particular projects under the Airport and Airway Development Act of 1970, the FAA has been able, to a degree, to influence the development of new facilities. The national, state and local continuous planning process conducted pursuant to this Act results in the periodically updated National Airport System Plan (NASP), which is the principal mechanism for channeling Federal funding.

State and Local

State and local roles and responsibilities for helicopter and commuter air facilities are fragmented, often unclear and sometimes controversial. This situation will probably impede rather than facilitate the options and potential benefits of these modes in the future.

Many states have an aeronautics board which is responsible for all types of aviation facilities and operations. Generally these boards and their staffs have responsibility for some or all of the following activities:

- Statewide airport system and air service planning
- Technical assistance to local areas and operators
- Administraton of financial grants
- Promulgation of rules and regulations
- Licensing and inspection

Prior to the Airline Deregulation Act of 1978 (P.L. 95-504), some states conducted economic regulation of intrastate air operations, as well as the intrastate portion of interstate flights.

Importantly, states are responsible for defining the extent of aviation regulatory powers and authority at the local level by state enabling legislation. Such legislation varies from state to state, but often provides for planning, zoning, building, fire and environmental codes, permits and procedures by a wide range of different local jurisdictions, including metropolitan planning commissions, counties, cities and towns.

Depending on the type and extent of enabling legislation, some localities such as large cities may have exclusive control over aviation permits, facilities and operations. Other areas, such as suburban towns and rural communities usually exercise zoning controls, but defer to state permit procedures and facility regulations. Occasionally, state or local government are themselves airport operators and therefore exercise additional control over helicopter and commuter air facilities and operations.

Most local areas have specific ordinances for airports, and some are coordinated with state and regional airport land use and development plans. Although relatively few local areas have ordinances governing the establishment and operations of heliports, the number of such ordinances is growing rapidly, without the benefit of either plans or technical guidelines.

State and local regulation of heliports is an important and sometimes controversial factor in the future growth of this mode. Issues such as public vs. private use facilities, state vs. local control, and the need for regional vs. local ordinances are emerging in some areas of the country. Their implications should be addressed at the national level as well.

Helicopter Ordinances

Many localities are, or may soon be, confronted with proposals for helicopter services and facilities. Most areas do not have plans or policies for integrating these proposals with other ground and air transportation modes. As a result, such proposals usually generate immediate action by local officials to adopt ordinances which are often either unnecessarily restrictive or fail to adequately address the legitimate public safety, welfare, environmental and transportation concerns of the local community. Some of the important issues concerning local helicopter ordinances are:

1. When and where is a helicopter ordinance necessary?
2. If an ordinance is appropriate, what kind of ordinance should be developed and by whom?
3. What provisions should an ordinance contain and what are the appropriate technical standards?
4. Can local ordinances be developed that relate to transportation system plans and are consistent across jurisdictional lines?

For many areas, especially small towns and rural communities, helicopter ordinances may not be the answer. For other areas, such as suburban, urban and large metropolitan areas where helicopter demand may increase substantially during the 1980s, piecemeal or comprehensive ordinances either exist or are being proposed. The geographic, economic and demographic diversity among these areas are some of the legitimate reasons why the nature and content of local ordinances should vary. However, some provisions are likely to be similar among most ordinances.

Local areas have a variety of heliport facility definitions and classification schemes ranging from the broad to the specific. Some of the most common definitions are:

- Public Use Facility: Open for use to any helicopter capable of using the facility regardless of ownership or control. Public use facilities constructed with public funds are sometimes given

preferential treatment or placed in a preferred class. In other cases, they might be discouraged in favor of greater reliance on privately funded and operated facilities.

- Private Use Facility: Owned or controlled by the owner or occupant of the premises for the exclusive use of the owner occupant, his guests or patrons.

- Heliport: An area, either at ground level or elevated on a structure, used for the landing and takeoff by helicopter.

- Helistop: Any area used for the landing and takeoff of helicopters, but does not afford refueling, maintenance, repair or other facilities and is for the accommodation of a single helicopter

- Helipad: Sometimes used synonomously with helistop

- Emergency Landing Areas: Refers to areas within the approach zone of a helicopter facility which can be used for emergency landings, and to rooftops and other areas for temporary or occasional helicopter use such as evacuation, but not formally designated as a heliport or helistop.

- Emergency: Includes rescue and ambulance missions, and other flights of unexpected and emergency nature.

Most large urban areas require a permit for helicopter facilities, approved and issued by an appropriate municipal review agency and sometimes approved by the city council and/or the mayor. Since most large urban areas have state enabling legislation which allow them to promulgate aircraft facility regulations, subsequent review and approval by a state aeronautics agency, or issuance of a state level permit in lieu of a local area permit, is usually not required.

Suburban and medium size urban areas which rely principally on zoning ordinances for control of helicopter facilities, usually issue conditional or tentative permits which are subject to final review and approval at the state level. In these areas, the weight of responsibility usually rests with the state aeronautics board, rather than the local jurisdiction.

More often than not small urban and rural areas have no local permit requirements. Helicopter facility applications are generally submitted directly to the appropriate state agency.

Conclusions and Recommendations Regarding Regulations

The conclusions drawn in this study regarding local helicopter ordinances are based on a brief overview of a small sample of local ordinances. The major issues surrounding helicopter ordinances have been identified, but are too broad and complicated to have been investigated further within the scope of this study. If the potential benefits of helicopter and fixed wing commuter air facilities and services are to be realized in the future, clear guidelines should be developed concerning:

- What level of Government (state, metropolitan, county, city, town) should be responsible for heliport regulation and how should commonality among different jurisdictions be achieved?
- What type of regulation, if any, is appropriate, when, and where?
- What are reasonable provisions and technical standards for local ordinances which will not preclude technological advances?
- How can transportation planning and the regulatory process be coordinated at the local level?

It is recommended that these guidelines be developed and implemented through a cooperative effort of government and the private sector, planners and operators:

- FAA should look into the dimensions and implications of these issues at the national level and provide guidance to states.
- States should streamline their own procedures and take action to prevent the proliferation of conflicting ordinances by each municipality. This might take the form of procedural and technical guidelines, or legislation.
- MPOs, in cooperation with state, city and county government should inventory all existing ordinances and develop proposals for reconciling these ordinances with ground and air transportation plans.
- The aircraft industry and operators should actively participate in determining the need for, and content of, state and local heliport regulation, especially in terms of technical advice and experience.

- NASA can play an important role by advancing technological priorities that will help to diminish the need for local ordinances for both helicopters and fixed wing commuter aircraft, especially in the areas of noise, safety and operating performance.

I. INTRODUCTION

The Rotorcraft and Commuter Air Transportation Benefits and Opportunities Study was conducted by the American Planning Association, in association with System Design Concepts, Inc. (Sydec) during the Spring and Summer of 1981. The work was sponsored by the National Aeronautics and Space Administration (NASA), Ames Research Center. This report presents the major findings and conclusions of the study, along with supporting documentation, analysis and discussion.

Purpose

The purpose of this study is to identify community planning needs, criteria and other considerations such as intermodal coordination and regulatory requirements, for rotorcraft and fixed wing commuter air transportation. This information, along with the results of a parallel study on aircraft technology opportunities conducted by the Helicopter Association International (HAI) and VITRO, Inc., form the background material for the national Conference On Planning For Rotorcraft and Commuter Air Transportation, held in Monterey, California in September, 1981. The results of this study and the consensus of the Monterey Conference are intended to provide a broad range of community planning guidelines, issues and information which can be used to:

- Direct anticipated aircraft technological improvements during the 1980s
- Assist planners in identifying and evaluating the opportunities and tradeoffs presented by rotorcraft and commuter aircraft options relative to other modes
- Increase communication between aircraft technologists and planners for the purpose of on-going support in capitalizing on rotorcraft and commuter air opportunities

Scope of the Study

This study addresses the state-of-the-art in community planning for rotorcraft and commuter air transportation. It focuses on the specific planning concerns and requirements for these modes, both qualitative and quantitative, of planners in different areas of the country, at different levels of government. The study highlights those planning needs that can be addressed by researchers, manufacturers and operators so that responsive programs and aircraft can be developed in the future that will facilitate the planning process, and maximize the benefits and opportunities to the community while minimizing adverse effects.

The primary tool for identifying and analyzing planning requirements was a detailed questionnaire administered to a selected sample of 55 community planners and others involved in planning for helicopters and commuter aviation. Secondary information sources included planning documents, available literature, local ordinances, supplemental phone contacts, and the results of the rotorcraft and fixed wing commuter air transportation workshop conducted at the national APA conference in Boston, April 27, 1981.

Organization of This Report

Following this introduction, the report consists of four sections and three appendices. Section II presents an overview of air transportation problems, rotorcraft and fixed wing commuter opportunities, and the information and communication needs of community planners and technologists. Section III summarizes the results of the national survey of planning needs and criteria, focusing on the 14 most important issues identified by planners, and the implications for different types of planning assessments, including economic, safety and others. In Section IV, the objective of an integrated ground/air transportation system is defined, and the requirements for access to, and interfacing among ground and air modes are presented. Section V summarizes regulatory roles at

different levels of government. The issues, major provisions and technical standards of selected local helicopter ordinances are identified, compared and discussed. The appendices contain a description of the survey design (Appendix A), a sample questionnaire with summary response data where appropriate (Appendix B), and a list of survey respondents (Appendix C).

II. COMMUNITY PLANNING CONTEXT

This section presents an overview of the air transportation problems throughout the Nation, and the opportunities presented by rotorcraft and fixed wing commuter aircraft. Community planners are identified, their roles and responsibilities in evaluating these opportunities relative to other modes are discussed, along with the need for planning guidelines and greater communication with aircraft technologists in order to direct technological priorities.

Nature of the Problem

Despite temporary energy shortages and higher fuel prices, intercity air transportation is expected to continue its steady growth over the next several decades, increasing its share of passenger travel relative to other modes. Rotorcraft and fixed wing commuter air services are expected to make a significant contribution to this growth.[1/] The reasons are varied. Major technological advances are expected, new public service and private markets are developing rapidly and travel patterns are changing especially in response to the value of time, where helicopters and commuter air services offer distinct competitive advantages.[2/] [3/]

At the same time airport and ground access facilities are nearing capacity in some areas of the country, and are underutilized in others as the result of deregulation. Conventional solutions to these problems (i.e., build more airports, expand existing airports, provide subsidized

---

1/Federal Aviation Administration, Aviation Forecasts Fiscal Year 1979-1980.

2/"Future Rotorcraft and Short-Haul Airplane Transportation Opportunities," unpublished paper by Jay V. Christensen and Louis J. Williams, NASA-Ames Research Center California, May 1979.

3/"Helicopter Outlook For The 80's," paper presented by Glen Gilbert, to the New England Helicopter Pilots' Association, January 17, 1980.

scheduled air service), are seriously limited because of economic, environmental, local regulatory and political constraints. Depending on the area (large urban, medium size urban, small urban/rural), rotorcraft and commuter air services and facilities may present alternative solutions.

Large Urban Areas

The 25 largest metropolitan airports account for over 65 percent of all air passenger boardings. Many of these facilities will reach or approach capacity in terms of peak period takeoff and landing capacity by 1990. At the busiest airports, delays are already common place. Air traffic growth and congestion is paralleled by ground access congestion on (1) highway links to the facility, (2) parking and circulation within the airport, and (3) passenger and baggage distribution within the terminal. Ground access congestion can limit airport capacity due to similar peaking characteristics.

Few new urban airports will be built during the 1980s because of high construction costs, lack of sites, organized opposition, and the difficulty in changing local ordinances. In some areas the capacity problem is aggravated by the closure and capacity constraints of nearby "reliever" airports due to urban development pressures and the growth of general aviation.[1/] For similar reasons, new highway and transit links to airport facilities are unlikely in most areas. At the same time population and industrial dispersion around major metropolitan areas is continuing. Over the past 5 years as many as 10,000 commercial and industrial plants may have located outside the perimeter of urban areas. Decentralization has increased trip distances, times and costs for most travel purposes by motor vehicle, and contributes to peak period congestion near urban airports.

1/ Year 2000 Regional Airport System Plan, Summary and Recommendations, Chicago Area Transportation Study, 1978.

Numerous innovative solutions are being investigated to increase airport capacity, including peak-period landing and takeoff pricing, peak-period quotas for certain categories of aviation (air carrier, air taxi or general aviation), and diverting general aviation, which accounts for from 10 to 30 percent of peak hour operations, to reliever airports.[1/] Similarly, staggered work hours, pricing mechanisms and other methods are available to increase roadway and airport capacity.

Rotorcraft and fixed-wing commuter air transportation present possible solutions to both ground and air capacity and congestion problems. For example, helicopters fly over and avoid all of the ground congestion at both on and off-airport locations. They do not share airspace and airport facilities with other long-haul aircraft operations or compete for runway space. Passengers using this mode between airports and to and from the CBD will usually not contribute to airport parking and circulation problems.[2/]

At the same time the public has negative perceptions regarding rotorcraft safety; heliports have been difficult to establish in densely settled areas, and air traffic control systems are not designed to account for the unique operating capabilities of these aircraft.

On the perimeter of large urban areas, helicopters are increasingly used by industry to:[3/]

- Provide direct access to corporate aircraft and commercial airlines at major urban airports

---

1/"Aircraft Delays At Major American Airports Can Be Reduced," by Robert E. Levin, U.S. General Accounting Office, Traffic Quarterly, Vol. 34, No. 10, October 1980.

2/"Role of Helicopter in Airport Access," by Jarir S. Dajani and William J. Snyder, Transportation Engineering Journal, November 1978.

3/Synthesis of Literature on Transportation/Economic Development, draft report by the National Council for Urban Economic Development for the U.S. Department of Transportation, September 1980.

- Shuttle executives, management, and customers to CBD meetings and among plants
- Pick-up and deliverly of parts and equipment

Air taxis and scheduled commuter aircraft, including STOLs (Short Take-Off and Landing) could substitute at both major and reliever airports for short to medium distance service by large commercial carriers requiring longer runways.

Medium Size Areas

Many medium size urban areas have excess roadway and airport capacity. Most have more opportunities to expand capacity at existing facilities or at new locations than large urban areas. The effects of deregulation have not yet indicated a clear pattern of operations growth at these faciliites, although there are some indications that they will benefit, especially from the expansion of commuter airlines using modern equipment.[1/]

The primary planning focus in these areas has been preservation of existing airports from residential encroachment, and establishing compatibility with existing adjacent residential communities by land use and noise control planning. Numerous examples from different areas of the country are available which demonstrate the successful development and application of zoning, easements, and noise ordinance criteria, in conjunction with airport, airline and pilot operational agreements.[2/] [3/]

1/"Friendly Skies for Little Airlines," by Peter Nulty, Fortune, February 9, 1981.

2/Executive Airport Comprehensive Land Use Plan, Airport Land Use Commission, Sacramento, California, October 1980.

3/"How to Control Airport Noise," by Kenneth J. Delino, Planning, The American Planning Association, November 1980.

However, the current difficulty in expanding existing or building new airports is due in part to the inability to make local zoning and noise ordinance changes for the numerous jurisdictions which are often involved, and to effectively use police powers (eminent domain). This has prompted local areas to investigate the option of finding aircraft (principally fixed wing commuter) which are adapted to existing airports instead of expanding airports to meet new aircraft demands. In other areas, the increasing use of helicopters in central business districts (CBDs) and suburban communities has prompted the development of heliport ordinances.

In medium size urban areas rotorcraft face difficult cost problems, and stiff competition with the auto, taxi and bus as an airport access mode. They have proven successful for special purpose travel, such as corporate business and emergency service, but must compete with fixed wing commuter aircraft for short distance travel to nearby cities. If the medium size urban area is located within 200-250 miles of a large metropolitan area, its airport facilities and helicopter, taxi and commuter air service can help to solve the capacity and congestion problems at major hub airports.

Small Urban and Rural Areas

Many small urban and rural areas do not have airport facilities, and many of those that do are experiencing the most negative impacts of deregulation. Service cutbacks and route and fare adjustments have increased passenger travel times and costs, narrowing the competitive edge over the automobile for trips under 200 miles between sparsely populated areas.[1/] Many of these areas are suffering an air transportation image crisis following the loss of jet service to hub

---

1/"Many Smaller Airports Stand to Lose More Flights With More Deregulation," The New York Times, March 8, 1981.

airports. Local officials are concerned about the economic development consequences of reduced service including fares, schedules, travel times, comfort and convenience, and the technological, financial and operational alternatives that may be available from rotor and fixed wing commuter aircraft.

In remote or mountainous areas with natural resource and vacation industries, rotor and STOL aircraft have unique capabilities that cannot be matched by other modes or by larger aircraft. In the past, planners in several areas of the country have taken significant steps to identify and meet the air transportation needs of small urban and rural communities.[1/] [2/] These plans will need re-evaluation in light of the changes brought about by deregulation, rising fuel prices and other factors.

Community Planning Roles and Responsibilities

Most planners are informed about rotorcraft and fixed wing commuter air transportation benefits and opportunities to the extent that they have a "need to know." That is, planners employed by airport authorities, state or county aeronautics departments have considerable expertise, while those who work for Metropolitan Planning Organizations (MPOs) and city or county planning departments focus on ground transportation modes, and are only peripherally and occasionally involved in air mode problems and issues, principally land use, congestion and noise control planning near existing airports.

As a result, planning roles and responsibilities for investigating the opportunities and evaluating the liabilities presented by rotorcraft and fixed wing commuter aircraft are not well defined. The subject is

---

1/ Utah Commuter Air Service Study, by T.A.P., Inc. for the Utah Department of Transportation, August 1977.

2/ Commuter Air Carrier Action Program, Wisconsin Department of Transportation, Division of Aeronautics, June 1978.

not taught in planning schools and relatively few consultants are involved. Few widely recognized guidelines and technical criteria for these modes are available to community planners. Alternatively, few lines of communication exist among community planners, technologists and the aircraft industry to interpret changing local air travel needs, develop planning guidelines, and direct technological development priorities.

Identification of Planners

Planners with rotorcraft and fixed wing commuter aircraft responsibilities and expertise are distributed across different levels of government, organizations and private industry:

Agency/Organization	Roles and Responsibilities
Federal Aviation Administration (FAA)	Develops National Airport System Plan (NASP) for funding airport and heliport facilities, develops administrative procedures and planning criteria and regulations for inclusion in the NASP as well as forecasts of air transportation. Regional FAA offices administer grant monies and monitor state and local area planning and project development.
Other Federal Agencies	Other Federal Agencies such as the National Aeronautics and Space Administration (NASA), the U.S. General Accounting Office (GAO) and the Civil Aeronautics Board (CAB) have legislative, research, planning, regulatory, and oversight responsibilities for aviation.
State DOTs and State Aviation/ Aeronautics Division	Develop or coordinate development of State Airport System Plans (SASP) for expanding airport facilities, statewide air transportation forecasts, and in some cases statewide air transportation needs and marketing analysis, in

	conjunction with other states and/or regional planning commissions. Often staffed with experienced airport operators and former pilots who have considerable operations, but little planning experience, and transportation planners with little or no air operations experience.
Regional Planning Commissions, Metropolitan Planning Organizations (MPOs)	Coordinate development of Regional Airport System Plans (RASP), collect data, make forecasts, develop policy altenatives and participate in air transportation committees, administer planning and project related grant money, but usually have no specialized expertise in rotorcraft or fixed-wing commuter aircraft transportation.
City and County Planning Departments and Transportation Departments	No specialized expertise, but are usually responsible for site and feasibility studies, needs analysis, zoning changes and land use plans. Often work directly with airport operators, consultants and facility sponsors in preparing technical studies and public participation including EIS. Often are the lead agency responsible for heliport ordinances, including review and approval of heliport permits.
Consultants	Work with state, regional and local government agencies to prepare airport system plans, air service studies, forecasts, site selection, EIS, cost analysis, facility operations and management plans, construction design, and development of local ordinances. Generally have a national perspective due to projects in different parts of the country.
Airport Authorities and Airport Operators	Airport operators participate in the development of SASP and RASP, provide data and often have technical staffs which participate in site selection and design of new facilities.

University Researchers	University researchers have made important contributions to short distance and special purpose transportation in recent years, particularly in the areas of airport accessibility and regulation. Universities have served as a forum for the exchange of air transportation planning information, particularly in the area of land use and noise impact analysis.
Aircraft Manufacturers and Associations	Vehicle technology, operations and marketing data as well as promotion and lobbying capabilities.

Planning and Technology Needs

A clear need exists for rotorcraft and fixed wing commuter aircraft planning information, and communication between community planners and aircraft technologists.

First, information suitable for use in transportation planning curricula, by consultants, airport operators, public agency planners, and public officials should be developed. This information could be used to:

- Develop and evaluate ground/air transportation system alternatives, where rotorcraft and fixed wing commuter air options have traditionally been neglected
- Plan and develop new facilities, such as heliports, which have been difficult to establish in the past in most areas
- Determine the need and appropriateness of local laws and regulations, such as zoning and helicopter ordinances
- Develop and coordinate a ground/air transportation planning process at the local level, and achieve better integration among different modes

Section III of this report describes the results of a survey of planners which identifies and gives a relative priority to some of these information needs. The most important needs should be addressed, and appropriate action taken to meet these needs.

Second, no established communication mechanisms exist between those responsible for rotorcraft and fixed wing commuter air transportation planning, and technologists responsible for aircraft development. The workshop conducted at the American Planning Association Conference in April 1981,[1] the Survey of Planning Needs presented in this report, and the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation in September 1981, are initiating communication. It is hoped that this communication will help to:

- Define community planning criteria and priorities, so that technological priorities can be directed to meet these criteria
- Make valid comparisons of the benefits and opportunities of rotorcraft and commuter aircraft with ground and other air modes

There is an important need to find some mechanism that will sustain this communication on a permanent, on-going basis.

Conclusions and Recommendations

Spurred by projected continued growth in air travel during the 1980s, technological advances and deregulation, rotorcraft and fixed wing commuter aircraft may offer distinct benefits and opportunities for different local communities, relative to other ground and air modes. However, most community planners focus on ground transportation problems and issues, and are only occasionally involved with air modes. Planning roles and responsibilities are not well defined, and few planning guidelines are available for rotorcraft and commuter services and facilities. At the same time, few channels of communication exist between community planners and aircraft technologists to ensure that aircraft technology development priorities are responsive to community planning criteria.

1/"Summary of the Boston APA Workshop," memorandum prepared by System Design Concepts, Inc., April 30, 1981.

Based on the above findings and conclusions, the study team recommends that:

- A permanent, on-going mechanism should be established to facilitate communication between community planners, and aircraft technologists and manufacturers, regarding the development of planning guidelines and the direction of technological priorities.

- NASA, in cooperation with APA, FAA, HAI and others, should develop and disseminate a technical manual for community planners emphasizing guidelines for evaluating rotorcraft and fixed wing commuter aircraft services and facilities relative to other modes.

- The community planners' technical manual should include, or incorporate the parallel development of, a study on local laws and regulations, especially helicopter ordinances, as described and recommended in Section V of this report.

III. SURVEY OF PLANNING NEEDS AND CRITERIA

The Survey of Transportation Planners and Consultants was designed to provide information on planners' and consultants' perspectives on community rotorcraft and commuter air planning. It dealt with such issues as what assessment criteria and parameters are important, and where further research is necessary, as perceived by planners in various levels of government, consulting firms and universities. These assessment criteria and parameters pertain to:

- Transportation planning data needs
- Marketing and economic analysis
- Facilities and operations planning
- Environmental and safety issues
- Potential impacts on communities' industrial base
- Existing transportation systems
- Quality of life

Description of Respondents

The survey sample consists of fifty-five respondents from all over the country, and from various types of agencies and levels of responsibility. Table 1 shows the distribution of respondents by type of agency and region. Since the intent of the survey was to obtain specific information from planners actually involved with rotorcraft and/or commuter air planning, rather than general opinions from transportation planners at large, an effort was made to locate planners with significant experience in the two subject areas. Respondents had an average of twelve years of overall planning experience, more than 60% of which was related to air transportation. The average respondent's air transportation experience was about 14% rotorcraft, 21% commuter air, and 65% other air related.

Table 2 shows the distribution of respondents by size of metropolitan area or planning region. Because small cities generally do not have

TABLE 1: DISTRIBUTION OF SURVEY SAMPLE BY AGENCY TYPE AND REGION

Agency Type	REGION								Total Respondents	Percent of Respondents
	Northwest	West/ Southwest	Central/ N. Central	Great Lakes	South	Northeast/ New England	Alaska	Hawaii		
FAA	1	3	1	2	2	2	1	1	13	24%
Consultant/ University	1		1		4	4			10	18%
State DOT or Aeronautics Division	1	2		4	2	1	1		11	20%
Port Authority		1			1	1			3	5%
MPO, RPC or COG		4	1	3	2	5			15	27%
City Agency		1		1					2	4%
County Agency		1							1	2%
TOTAL RESPONDENTS	3	12	3	10	11	13	2	1	55	100%
PERCENT OF RESPONDENTS	5%	22%	5%	18%	20%	24%	4%	2%	100%	

TABLE 2: DISTRIBUTION OF RESPONDENTS BY CITY SIZE OR PLANNING REGION

Area	
City Size:	
Large City (1,000,000+ population)	14
Medium City (less than 1,000,000 pop.)	2
Planning Region:	
Statewide	11
Sub-state (county, multi-county)	5
Multi-state (FAA region)	13
Other:	
Consulting firm, university	10
Total Respondents	55

large planning staffs, no small cities are represented at the municipal level. However, persons who do air transportation planning for smaller communities are included in county-wide or regional (multi-county) planning agencies.

More detailed information on the design of the questionnaire, sample selection process, and analytical techniques is presented in Appendix A, "Survey Design."

Key Concerns of Planners

This section summarizes the survey results in terms of the transportation missions or roles for rotorcraft and fixed wing commuter aircraft that are important to planners, and the most important issues that relate to these roles.

Transportation Missions

Rotorcraft and fixed wing commuter aircraft currently provide a wide range of transportation services, both public and private. Planners are in a good position to evaluate the relative importance of these services today, as well as their changing priority over the next ten years.

Table 3 presents eight transportation missions and an indication of their importance in terms of planners' perception of their current role (1980) and their future role (1990). For rotorcraft, public service (police, fire, rescue, etc.) is the most frequently chosen mission in both 1980 and 1990, with business/corporate second, and construction and energy exploration third and fourth. While public transportation is sixth for 1980, that role is expected to grow the most by 1990, from a 29% choice in 1980 to 47% in 1990, possibly indicating a growing interest by planners in the use of rotorcraft for public transportation between CBDs and airports and other services.

TABLE 3: RELATIVE IMPORTANCE OF ROTORCRAFT AND FIXED WING COMMUTER TRANSPORTATION MISSIONS, 1980 AND 1990

Missions	Rotorcraft				Fixed Wing Commuter			
	1980		1990		1980		1990	
	Percent Responding	Rank	Percent Responding	Rank	Percent Responding	Rank	Percent Responding	Rank
Public Transportation (CBD-CBD, CBD-airport, airport-airport, other)	29	6	47	5	73	2	76	1
Public Service (police,fire,rescue, etc.)	89	1	93	1	9	6	16	4
Business/Corporate	60	2	75	2	76	1	76	1
Cargo, Goods Movement	24	7	33	7	38	3	51	2
Construction	58	3	64	3	5	8	7	6
Energy Exploration	49	4	60	4	16	4	18	3
Forestry	33	5	44	6	11	5	7	6
Other	24	7	25	8	7	7	9	5

For fixed wing commuter aircraft, public transportation and business/corporate are by far the major roles in 1980 and 1990, but cargo/goods movement shows a large anticipated growth in importance, from 38% in 1980 to 51% in 1990.

Important Issues

Respondents were asked to rate each survey question issue in terms of importance relative to the type of planning in which they are currently engaged. Table 4 shows the 14 highest rated issues out of a total of 46 issues that were addressed in the survey questionnaire. A sample questionnaire with detailed answers and ratings for each of these issues is presented in Appendix B. The 46 questions dealing with planning issues are those in Groups C, D and E of the questionnaire under the categories of:

Group C: Transportation Planning
Group D: Aircraft Characteristics
Group E: Impacts

Respondents' ratings of the importance of all questions have also been examined as functions of geographic location, amount of rotorcraft and commuter air experience, level of job responsibility, and city/planning region size. In most cases, no appreciable differences are found. Some obvious distinctions have been noted (for example, air traffic congestion is not a major issue for Alaskan respondents). Several respondents from the densely populated Northeast comment that commuter airport locations and design criteria are not important because no new facilities could be expected to be built in the region. Environmental issues (noise, community intrusion) are important to all respondents, but slightly more important in the most populous regions (Northeast, Great Lakes, West). For example, Questions DI.1 and DI.3, dealing with noise, both receive overall ratings of 1.5, but are rated 1.8 in the most populous regions.

TABLE 4: THE 14 MOST IMPORTANT ROTORCRAFT AND FIXED-WING COMMUTER AIRCRAFT PLANNING ISSUES[1/]

Question	Topic	Relative Importance	Mean Rating
CIII.1	Airport/Heliport location	1	1.8
CI.1	Planning data	2	1.7
CI.2	Adequacy of planning data	3	1.5
EI.1	Transportation Service Factors	3	1.5
DI.1	Noise measurement parameters	3	1.5
DI.3	Far-field noise	3	1.5
EII.4	Environmental Impact	4	1.4
DIV.1	Vehicle Performance	4	1.4
CIII.4	Legal/Regulatory data	5	1.3
CI.3	Defining markets	5	1.3
CII.1	Ground access	5	1.3
DI.7	Community intrusion	5	1.3
CII.2	Air traffic congestion	6	1.2
DII.1	Safety statistics	7	1.0

[1/]Out of 46 questions which had rating boxes, only 4 were considered very important (+2) by 50% or more of the respondents, and 11 were rated +2 by 40% or more. Those 11 questions are listed, as well as three which received the highest percentage of +1s (somewhat important), for a total of 14. The questions are ranked in descending order, based on the mean ratings, excluding those who left a rating box blank.

Airport/Heliport Location

The issue rated the highest importance among planners is defining criteria for determining the location of heliports and airports. For both heliports and commuter airports, the principal factors in order of importance are the same: ground access, safety and distance from the CBD. Also of importance for heliports are proximity to users and noise. For airports, noise, cost of construction, proximity to users and ground and air space requirements follow the primary factors.

What criteria are important in determining heliport/airport location?

Location Criteria	Heliport	Airport
Distance from CBD	89%	77%
Cost of construction	66%	72%
Ground access	97%	85%
Air space	70%	68%
Safety	93%	79%
Proximity to users	85%	70%
Space requirements	68%	68%
Other locational requirements	50%	39%
Noise	79%	77%
Other environmental	50%	54%
Proximity to schools, hospitals, parks	60%	56%
Other	22%	22%

Looking at responses to this question by size of city or planning region shows that the five most important (most frequently selected) parameters for heliport location are the same for each group, with little exception. State-level respondents also express concern about construction costs; FAA respondents show interest in air space, and the consultant/university group is also interested in land requirements for heliports:

Ranking of Heliport Location Criteria by Respondent Groups

Location Criteria	All 55	Large City	Medium City	County/ Regional	State	FAA	Consultant or Univ.
Ground access	1	3	1	1	1	4	1
Safety	2	4	2	2	2	2	4
Distance from CBD	3	1	3	3	3	1	3
Proximity to Users	4	2	4	4	-	3	2
Noise	5	5	5	5	5	5	5
Other Criteria[1]	-	-	-	-	4[1]	5[1]	5[1]

For commuter airports, the same five parameters are important to respondents in all six categories, and cost of construction is also important to all respondents. Land requirements for commuter airports is also an important concern to respondents from large cities, state agencies, and the consultant/university group.

Planners may be showing their concern for accessibility relative to other modes. Unless heliports and commuter airports are easily reached, travelers will make their trips by auto. For heliports, locations in the CBD in close proximity to users are plentiful, but usually lack adequate parking, and permits are difficult to obtain because of noise, safety and zoning considerations. A number of cities prohibit rooftop helistops. For airports, noise levels, rising costs and diminishing available land are seriously constraining both on-site expansion and the development of new airports.

Planning Data/Adequacy of Planning Data

The availability of planning data and the adequacy of these data are the second and third most important issues. Planners would like to have similar data bases for rotorcraft and commuter air that are available for

[1]Other criteria frequently mentioned include construction cost (4th ranking for state-level respondents), air space (5th ranking for FAA respondents and land requirements (5th ranking for the consultant/ university group).

other modes. Information on the users is rated higher than data on vehicles (take-offs, landings, number of rotorcraft, etc.). The consensus of planners is that there is very little data concerning who the users are, for both rotorcraft and commuter air operations. Planners agree that little is known about the origin-destination patterns, trip frequency, trip lengths, mode of access, modal split, or demographic characteristics (income, auto availability, etc.) of the users. These data are essential for planning new facilities and operations and forecasting future needs.

What types of planning data are important to you for determining the need for rotorcraft/commuter air services?

Planning Data	Rotorcraft	Commuter
Origin, destination data	93%	81%
Travel patterns	73%	67%
Modal split	67%	59%
CAB service segment data	34%	34%
Others	40%	36%

Does adequate planning data exist and is it accessible?

Rotorcraft: 14% yes, 89% no
Commuter: 17% yes, 83% no

Another important point is that the lack of stability in service (schedules, fares, etc.) has a detrimental effect on establishing ridership. Dependability is one of the most important attributes of a transportation service, and people base their travel patterns around the trip schedules. If flights are frequently off schedule, or are canceled, and schedules keep changing, ridership will diminish. Constantly fluctuating fares can have a similar effect. Data on reliability and fare structure is needed to determine ridership elasticities for these factors.

Transportation Service Factors

Planners feel that the most important service factors offered by rotorcraft are connections among modes, door-to-door trip cost and time savings, and the potential for linking communities. These factors are similar for commuter air, but in a different order of importance. Linking communities is most important, followed by intermodal connections and trip cost and time savings benefits.

Which service factors are most important to you as a planner?

Service Factors	Rotorcraft	Commuter
Potential door-to-door trip cost and time savings	60%	52%
Linking communities via transportation	49%	64%
Increased productivity (passenger/ cargo per acre) of land	23%	11%
Reducing ground and air traffic congestion	45%	39%
Inter-modal connections	65%	52%
Safety benefits	23%	27%
Other	1%	3%

The emphasis on these factors points to a gap in our current ground-air transportation system that planners feel might be filled by rotorcraft or fixed wing commuter modes. This gap exists where:

- Ground access to outlying airports is time consuming and costly due to congestion. For example, in New York City it can take longer to get from Wall Street to LaGuardia than the flight from LaGuardia to O'Hare in Chicago.[1/] Some cities have built or are constructing rail links to airports (N.Y., Boston, Washington, D.C., Cleveland and Philadelphia), but travel time can still be lengthy. Helicopter service to these airports

1/"Airport Access: Are Rail Links the Answer?" OAG/Frequent Flyer, July 1981.

represents an alternative, which in some cases is even less expensive than taxi fare, and certainly faster. (Taxi fare from mid-town Manhattan to JFK Airport averages about $20, while a combined ticket for New York Helicopter and the participating airline may add only $12 to the regular air fare, and take 5 to 20 minutes vs. 30 to 90 minutes by taxi.[1] Subway/bus JFK Express service is $4.00 and takes about 70 minutes). In 1977, the FAA and Transportation Systems Center studied the constraints on air travel caused by inadequate ground access, and found that "inadequate ground access capacity currently causes excessive delay to the air traveler at thirteen of the sixteen airports studied."[2]

- Trips from smaller communites to hub airports near large cities are long or circuitous. In large states with only one or two major population centers served by commercial air carriers, such as in Colorado or Utah, distances from most smaller communities to the hub airports near the large cities may be several hundred miles. In remote areas, such as Alaska, air transportation is vital, due to the terrain, and is important for transportation of food, equipment, and medicine, as well as people. Travelers may have to wait several days for a flight for a trip which they could not make at all by any other mode.

- Service among small cities or to hub airports by commercial airlines was eliminated or curtailed due to deregulation, or never existed. Commercial carriers have dropped non-stop flights between smaller cities, and have focused on a "hub-and-spoke" system where flights go from small city to hub, from hub to hub, and from hub to small city, a time consuming three flight trip. Air carriers have dropped many towns and reduced the number of flights as fuel costs and fares have gone up and ridership has gone down. For example, Republic Airlines dropped 23 towns in early 1981, and Grand Rapids, Mich. lost 34% of its daily departures.[3]

Thus, many factors are causing planners to look toward rotorcraft and commuter air transportation to help fill these gaps in the transportation network.

1/"By Copter to the Airports, Far Above the Potholes," New York Times, Friday, May 29, 1981.

2/Airport Ground Access, FAA, October 1978.

3/"Many Smaller Airports Stand to Lose More Flights with More Deregulation," New York Times, Sunday March 8, 1981,

Noise Measurement Parameters/Far-Field Noise/Environmental Impact

Many planners agree that far-field noise is a problem for rotorcraft, particularly in CBD heliport locations, and residential areas near commuter airports. In terms of evaluating noise levels, most planners select Ldn as the desired measurement for noise, since it has been accepted by the FAA and EPA. Noise contour/land use maps were the most frequent choice for analyzing far-field noise (noise "footprints"). For rotorcraft and commuter air, noise and community intrusion are the main issues. Air pollution is not considered as much of a problem. Most planners agree that a measure of the number of people exposed is important as well as actual levels.

Which noise level parameters are most useful to planners?

dBA	30%
Ldn	74%
EPNdB	17%
CNR	1%
NEF	19%
Other	17%

What type of data are needed to evaluate far-field (community) noise?

Maximum levels	60%
Number of occurrences	78%
Noise contour/land use maps	86%
Other	18%

Which criteria are most important in evaluating vehicle interior noise levels?

Maximum levels	33%
Average levels	38%
Pass. minutes of exposure	21%
Other	2%

What are the best ways of quantifying environmental impact of rotorcraft/commuter air operations, compared to other modes for:

Noise	83%
Air pollution	25%
Community intrusion	67%
Other	13%

Planners express the desire for improved VTOL and STOL craft for minimizing land acquisition for new facilities, and for preserving recreational and agricultural land in outlying areas. Environmental issues are most important to respondents from areas with high population

densities. For example, on Question CIII.4 (legal/regulatory information needs), environmental regulations are generally the second or third choice for most areas, but are the first choice for the Northeast/New England Region and for respondents in large cities.

Vehicle Performance

In general, planners show some interest in all aspects of vehicle performance, but emphasize runway lengths needed by commuter aircraft. Land availability and cost are important considerations for locating airports, and, particularly in large urban areas, there is a need for short take-off aircraft facilities. STOL may also allow use of aprons or taxiways freeing main runways from some of the commuter segment of air traffic. Weather stability and navigational guidance systems are other important factors for rotorcraft and commuter aircraft, from a safety point of view and for increased reliability of flight schedules. In addition, poor ride quality during inclement weather is a performance factor which tends to deter potential ridership. Obviously, travel speeds are important in determining competitiveness of air travel, and fuel consumption rates are essential for cost analysis.

What performance characteristics of the aircraft are important for planners?

Performance Characteristics	Rotorcraft	Commuter
Runway lengths	0%	93%
Acceleration, deceleration, climbing and descent rates	47%	52%
Maximum and cruising speeds	41%	33%
Vehicle weight/seat (payloads)	50%	45%
Weather stability	58%	47%
Navigational/guidance system	58%	58%
Other	14%	12%

Planners want to know more about the performance of state-of-the-art aircraft to help develop future services. Data on speed, fuel consumption, noise and vibration levels and runway requirements will assist in correlating local needs with the various types of aircraft.

Legal/Regulatory Data

Zoning, jurisdictional authority and environmental regulations are the primary concerns. While some planners state that the process of obtaining various permits and authorizations needed for new facilities is sometimes straightforward, others complain that in many areas inconsistencies exist among different local jurisdictions, that obtaining local permits is often time consuming, and that some local ordinances are unnecessarily restrictive. The preparation of an Environmental Impact Statement is a costly, time-consuming process, usually contracted out to consulting firms.

What legal and regulatory information is needed for rotorcraft/commuter air planning?

Zoning, eminent domain	80%
Environmental regulations	72%
Landing fees	21%
Jurisdictional authority	72%
Curfews	29%
Regulatory authority	60%
Air space allocation	39%
Other	3%

How complicated and involved is the process of obtaining approvals and authorization for heliports and airports?

Heliports: mean = 1.8

Airports: mean = 2.0

NOTE: 1.0 = "not very,"
3.0 = "very"

Interestingly, respondents from the consultant/university group perceive the process of obtaining approvals and authorizations as more difficult than perceived by other groups. They gave a mean rating of 2.2 for heliports (compared to a mean of 1.8 for others) and 2.3 for commuter airports (compared to a mean of 2.0 for others).

Planners are concerned about overlapping jurisdiction and authority in terms of regulating operations and safety of small aircraft in urban areas, particularly for rotorcraft. The question of airport operators determining the types of aircraft allowed to use a particular facility vs. the FAA's authority to ensure the efficient utilization of air space, is an example of overlapping or unclear jurisdiction. Also, many planners state that local ordinances restricting the use of rotorcraft over cities, or not allowing roof-top heliports, are ill-conceived and based on ignorance. Planners want to know more about such safety questions as the structural ability of building roofs to support helicopter operations, related five safety considerations, etc.

Defining Markets

The need for market surveys to determine travel habits and socio-demographic profiles of current users and latent demand for potential users is strongly emphasized. Planners also are in need of determining the price-elasticities associated with helicopter and commuter air travel relative to competing modes.

What data are important in helping planners define market areas and potential user groups?

Market surveys	86%
Commodity traffic studies	54%
Other	39%

Planners must have both the analytical tools and the data to determine which market segments are economically feasible, for the various rotorcraft and commuter air missions. Modeling work, such as done by Dajani, et al,[1/] would help planners determine passenger demand density thresholds needed for developing enough ridership to make operations profitable. State-of-the-art operating cost data for various types of aircraft are essential for such analyses.

Market research into the feasibility of various missions should include the distribution of types of businesses and industries, as well as individuals, in different size cities, to help determine where demand might exist for corporate office-to-plant, or plant-to-plant routes, via rotorcraft and/or commuter aircraft.

Ground Access and Competing Modes

While data on travel time and congestion, along with modes, routes and vehicles, are planners' major needs concerning access to airports and heliports, cost data are also a major factor in comparing line-haul ground transportation modes with air travel. For trips which are feasible by auto, train or bus (up to several hundred miles) the high cost of air travel tends to off-set the time savings, which may be minimal due to airport location, access and congestion problems. Because passengers will not tolerate long access and waiting times for trips, frequent, easily accessible air service must be provided at a competitive cost. This is highlighted in responses to other questions concerning the need for a new generation of commuter aircraft which can operate more efficiently, with lower fuel consumption and maintenance costs, and for VTOL and STOL craft which can operate from facilities in, or close to, the CBD, and which can compete economically with ground modes.

[1/] The Potential for Helicopter Passenger Service in Major Urban Areas, prepared by Dajani, Statstrom and Warner, March, 1977, Duke University Environmental Center.

What data on existing ground transportation are important to you concerning competing services and ground access to rotorcraft/commuter air facilities?

Transportation Data	Competing	Ground Access
Modes, routes, vehicles	71%	72%
Travel time, speed, congestion	70%	72%
Travel costs	85%	60%
Operating agencies	39%	33%
Facility location	50%	50%
Other	8%	8%

Community Intrusion

A study of the frequency and nature of complaints can be a useful measure of the effects of nearby facilities on the community. Changes in land values and properties for sale are also useful measures. Intrusion may be caused by noise and air pollution from over-flights, as well as traffic and congestion generated by the facility. Planners are calling for more research into the effects of airports and air operations on property values, and the economic health of a community.

How can impacts of community intrusion of airports/heliports and flightpaths be measured?

Changes in land values	54%
Changes in property sales	49%
Complaints	78%
Other	21%

A second issue is the intrusion of the community into the airport. As previously discussed, secondary airports in outlying areas should be preserved, as they may become vital as reliever and commuter airports in the future. Land surrounding airports should be retained and zoned to prevent vertical intrusions into airspace, or noise sensitive land uses (such as residential) too close to the airport. Many planners are in positions where they must face the public on these issues, and they want

to be well-informed. These issues seemed to be most important at the local level, and somewhat less important at the statewide level. The ratings for selected groups are as follows:

State	1.8
FAA	1.3
City and County	1.4
Consultant/university	1.7
Overall	1.3

Air Traffic Congestion

Allocation of air space for rotorcraft is one of the main concerns. Some planners expressed the opinion that separate air space over large cities and at airports should be assigned to rotorcraft, to ease the burden on air-traffic controllers, and to provide clear air space for short haul aircraft. Air traffic congestion is not such a major issue for smaller cities, as would be expected.

What data are needed on air traffic congestion?

Data on Traffic Congestion	Rotorcraft	Commuter
Allocation of air space	68%	56%
Flight frequency	66%	58%
Landing patterns	60%	52%
Air traffic control (terminal)	52%	41%
Curfews	29%	21%
Delays and causes	37%	31%
Other	9%	9%

Reliever airports and commuter airports help reduce congestion at major hub airports. However, separate airports create the problem of getting from a commuter flight to a connecting commercial flight. In fact, connecting from one flight to another may be difficult within the

same airport. Thus, there is a conflict between providing easy access and modal transfer (by having all facilities at the same airport) with reducing air traffic congestion (by encouraging the use of reliever airports). STOL and VTOL craft which can land on separate runways, then taxi to gates which are close to the commercial airlines, is a possible solution. Peak-hour pricing could shift general aviation and air taxi operations to other time periods, but would make it even more difficult for passengers to connect with commercial flights.

Safety Statistics

Accidents per passenger-mile is the most important safety statistic identified. Planners are somewhat familiar with the availability of data on rotorcraft and commuter air safety, but are concerned about the perception of safety by potential riders, and by public officials. Planners would like to be kept up-to-date on the safety and reliability of the latest in aircraft technology. For example, the public perception that helicopters would "drop out of the sky" with a failed engine would be alleviated knowing that rotorcraft can glide, often with more ease than a fixed wing aircraft, or, for example, that the new Augusta 109-A is powered by two jet engines and can run on one if necessary.

What type of safety data are important to you as a planner?

Accident per flight	46%
Accidents per veh-mi	40%
Accidents per pass-mi	51%
Accidents including innocent bystanders	10%
Fatalities per accident	42%
Fatalities to bystanders per flight or veh. mi.	26%
Incidents (near-accidents)	32%
Other	16%

What aspects of safety are most important and/or need the most research and development?

	Rotorcraft	Commuter
Engine failure	33%	17%
Rotor-blade failure	43%	5%
Navigational/landing systems	35%	41%
Weather-stability	41%	33%
Crew training failures	33%	30%
Other	10%	2%

Is there a major difference between the public's perception of safety and actual data?

Rotorcraft: 72% yes, 28% no
Commuter: 76% yes, 24% no

Statistics on scheduled helicopter service safety are scattered because of the newness of service. Most helicopter accidents occur in hazardous missions during emergencies, or in carrying equipment to off-shore oil rigs. A recent study of helicopter accidents showed that rates per 1000 hours flown has steadily decreased since 1969, and that the number of innocent bystanders injured was extremely low.[1/]

In addition to the fourteen most important issues, nine other questions received a +1 or +2 rating by at least 30% of respondents, as well as a mean rating of 1.0 or higher. These issues are listed in Table 5, and responses to each question are described briefly below (to the extent that they have not been covered above).

The process of obtaining approvals and authorizations was discussed on page 31. System information needed for comparing rotorcraft and commuter air to other modes is of relatively high importance for all data, including travel time and cost, operating costs, capital costs,

1/"Analysis of Helicopter Accident Risks," J. Feir, PRC Speas; Aviation Concepts, May 1980.

TABLE 5: Nine Other Issues of Some Importance

Question	Topic	Relative* Importance	Mean Rating
CIII.5	Obtaining approvals and authorizations	8	1.3
CII.3	System information needed (relative to other modes)	9	1.2
EI.2	Effects on industry base	9	1.2
CIII.2	Heliport/airport configuration	10	1.1
DII.3	Public's perception of safety	10	1.1
DII.2	Safety research	11	1.0
DII.6	Measures of productivity	11	1.0
EII.3	Reducing fuel consumption	11	1.0
EII.1	Police, fire, rescue benefits	11	1.0

*Ranking continued from Table 4 on page 23

etc. In general, fewer respondents show concern for this type of data for commuter air compared to rotorcraft, probably indicating that less data of this type exist for rotorcraft, and are therefore seen as a more important need. Other comments on this issue indicate that location and accessibility are critical factors in comparing modes, and this would include ease of transfer at airports (from commuter to trunk, for example), ground access, etc.

What information is needed for rotorcraft and fixed wing commuter aircraft relative to other modes?.

	Rotorcraft	Commuter
Door-to-door trip times	74%	60%
Cost to passengers or shippers	74%	54%
Cost to operators, subsidies	62%	45%
Fuel Costs	68%	48%
System cost (infrastructure, construction, maintenance)	68%	54%
Other	11%	5%

The responses to the question on effects of commuter and rotorcraft transportation on the economic base of communities indicate that inducement to new industries is the most important effect for both modes, and decentralization of manufacturing is second. Centralization of corporate management is seen as an important benefit of rotorcraft operations, either from CBD to outlying facilities or among several outlying locations.

Which of the following do you feel are important potential effects on the industrial base of communities from rotorcraft/commuter air transportation?

	Rotorcraft	Commuter
Decentralization of manufacturing	48%	25%
Centralization of corporate management	44%	16%
Reducing energy consumption in construction activities and operating ground facilities and supporting infrastructure	32%	9%

Improved tax base	34%	23%
Inducement to new industries	51%	30%
Other	11%	11%

The question of important factors in determining heliport or airport configuration shows noise to be a prime factor for heliports, followed by cost. Cost and noise are first and third for commuter airports, with dimensions (amount of land or space needed) as the second choice. The approval process is also an important factor for both.

Which factors are important in determining heliport/airport configuration?

	Heliport	Airport
Cost	65%	71%
Dimensions	65%	68%
Approvals (CAB, local)	57%	47%
Noise	68%	65%
Refueling, maintenance	28%	26%
Passenger comfort	28%	31%
Other	15%	15%

The next two most important issues are public perceptions of safety and safety research; these were discussed on pages 36-37 because they are closely related to the other important issue of safety statistics.

The question of productivity and how best to measure it is the next most important issue to planners. Cost per passenger-mile or ton-mile are the most frequently selected measurement parameters. In the recommendations by planners for operators, summarized at the end of this chapter, a number of respondents indicate the need for operators to apply management techniques to improve productivity and efficiency of operations. There is also a call for manufacturers to design more efficient and productive vehicles, tailored to the demands of the commuter market.

The next most important issue is closely related to productivity -- i.e. the question of reducing fuel consumption by using rotorcraft or commuter aircraft more effectively for specific missions. Specialized activities, such as construction, are perceived as being the types of missions for which rotorcraft offers the most potential for fuel savings. Short distance flights among small cities, and from small city to hub are perceived as having the greatest potential for fuel savings for commuter aviation.

What are the potential missions in which rotorcraft/commuter air services can reduce fuel consumption?

	Rotorcraft	Commuter
Short haul commuter flights (smaller vehicles)	30%	65%
Airport-airport connections	34%	16%
Air taxi (urban)	30%	16%
Feeder to large hub airports	30%	41%
Specialized business and construction activities	58%	13%
Corporate (plant-to-plant)	23%	18%
Other	9%	4%

Rotorcraft have proven their unique capabilities for rescue in emergency situations, as well as aiding in police work. Some measure of lives saved or reduction in crimes, per dollar of operating cost would be a useful measure for analytical purposes.

What are the best ways of quantifying potential improvements to police, fire, disaster control, and rescue services through use of helicopters?

Lives saved per $	45%
Crime reduction per $	47%
Arrests per crime	20%
Response time	43%
Other	6%

Summary of Responses by Planning Assessment Category

The preceding section discussed the survey results in the order of importance of the various issues to planners, without giving much attention to the interrelationships among the various specific issues, and without giving attention to the less important, but related isssues. To provide a more general, comprehensive overview of the survey results, this section summarizes the results of all 46 survey questions from Groups C, D and E according to six planning assessment categories:

- Economic
- Safety
- Community Quality of Life
- Limited Fuel Environment
- Interfacing with Other Modes
- Other Assessment Parameters

To the extent possible, geographic variations and differences among type of planning agency or city size are noted in the discussion of responses under each of these six categories.

Economic

The economic issues which are of importance to planners are those which affect the competitiveness of rotorcraft and commuter air with other modes. A prime concern of planners is the instability of service. With deregulation, some commuter airlines have come into being without the proper financial backing and/or without a realistic forecast of what their operating and indirect costs would be (fuel consumption, maintenance, insurance, etc.). Many new services quickly go out of business, making the public more reluctant to rely on such services. And, since businesses, as well as individuals, make locational choices partly based on transportation, it is very disruptive when new services are unreliable and unstable. Thus, planners who are involved with trying to establish air transportation service in their communities are concerned with economic viability.

In response to questions DIII.1-7 on the survey (economics, fuel efficiency, maintainability and productivity), planners are particularly interested in the number of employees needed for crews and ground support, wages, productivity, fares and cargo revenue, insurance costs, taxes, fees, and measures of productivity in terms of dollars per passenger-mile or ton-mile. In addition, planners are interested in many aspects of maintenance, such as overhaul schedules (hours and/or miles between overhaul), down-time and percent availability of aircraft, etc. Question DIII.6 (productivity) is the highest rated of these seven questions. Questions DIII.3, 4 & 5 are also important. The distribution of responses to these questions are summarized below:

Which information on <u>direct operating costs</u> and <u>revenues</u> is important? (DIII.3)

Crew Size (and ground support personnel)	55%
Wages, productive time	45%
Fuel efficiency, cost	27%
Fares, cargo revenue	45%
Subsidies	32%
Other revenue	17%
Other	7%

Which <u>maintenance</u> information is important? (DIII.4)

Miles beween replacement of components	35%
Hours between replacement	52%
Overhaul schedules	47%
Time needed to make repairs	47%
Percent flight availability	47%
Maintenance costs per task	41%
Other	8%

Which information on <u>indirect operating costs</u> is important? (DIII.5)

Insurance costs, liability	70%
Taxes, fees, etc.	58%
Other	12%

What measures of productivity and passenger/cargo costs are important? (DIII.6)

	Rotorcraft	Commuter
$/seat-mile or plane-mile	50%	44%
$/pass.-mile or ton-mile	69%	63%
$/ton-mile	30%	33$
Personnel per passenger/ton	16%	16%
Vehicle capacity,thru-put	38%	38%
Other	8%	8%

Planners' comments on economic issues also focus on the need for designing more efficient aircraft. There is a need for a new generation of rotorcraft and commuter aircraft which would be designed specifically for low fuel consumption and sized for high load factors in the shorter distance commuter market. Data sources, such as the Commuter Airline Industry Annual Report, and the Helicopter Buyers Guide, provide performance and fuel consumption data on the latest aircraft.

Another key issue is determining the economic feasibility of providing air service in the lower density markets, and planners have expressed the desire for discussions with operators and manufacturers to determine what is technically feasible in the near future. Southwest Airline in Texas provides "bare bones" service (no meals or baggage transfers to connecting flights, etc.) using Boeing 737s with a fare of $20.38 per passenger on a 250 mile flight compared to United Airlines $43.96 for comparable distances.[1/] The next generation of commuter aircraft is expected to further reduce operating costs, which would further the competitive position of commuter aviation.

In terms of economic effects on the community, planners feel that there are several areas in which better air transportation can be beneficial. As was previously described, Question EI.1 is one of the

1/"Friendly Skies for Little Airlines," Fortune, February 1981.

most important to planners responding to the survey. The provision of connections among CBDs, between CBD and outlying airports, linking small communities which are currently without good inter-community transportation, tying smaller communities into hub airport and commercial airlines, are all important benefits. Other benefits to individual communities, as indicated by the responses to Question EI.2 (effects on industry base) show that planners are aware of the inducement to new industry provided by good accessibility to air transportation. Linking central city management with outlying plants and facilities by rotorcraft, providing efficient, quick transportation among various locations of a particular industry (which may be spread over several states), and the ability to transport employees, parts and equipment from site to site, are all benefits which strengthen a community's or region's economic base. For example, Timex Corp. in Waterbury, Connecticut, operates two helicopters which carry top executives, middle-level managers and parts among a number of offices, plants, heliports and airports in the region. Mack Truck Corp. flies customers from Kennedy Airport in N.Y. to its world headquarters in Allentown, Pa., which has no direct flights from JFK and is more than a three hour drive away.[1/]

There is a clear need for further research into the economic effects which deregulation is having on communities of different sizes, and on businesses and various segments of the economy. Research is needed on the relationship between airport location, levels of air service available, and industrial location and business growth. Planners agree that this is not easily quantified, but there appears to be enough evidence that there are direct relationships between good transportation and economic vitality of a region.

1/ Synthesis of Literature on Transportation/Economic Development, draft report prepared for U.S. DOT, Office of Transportation Economic Analysis, by National Council for Urban Economic Development, Washington, D.C., September 1980.

Safety

As was discussed previously, safety is among the top fourteen issues rated by respondents to the survey. Planners are in need of hard statistics to compare rotorcraft and commuter air safety to other modes, such as accidents and fatality rates per passenger-mile. The over-riding concern is the public's perception of instability of small aircraft, which leads to public resistance to use rotorcraft. Planners also sense that the media's pre-disposition to sensationalize air crashes has helped foster an image of danger, and consequently public officials are reluctant to speak out in favor of small aircraft operations.

As data become available, documentation of rotorcraft safety records for public transportation operations, as well as commuter air safety, should be widely disseminated.

Research is recommended for providing increased all-weather capability and improved navigational aids. Some planners suggest development of heliport approach instrumentation for all-weather flying.

Community Quality of Life

Planners are in agreement that rotorcraft have helped in improving the quality of life, in several important ways. Primarily, the use of rotorcraft in emergencies for evacuating fire, accident or disaster victims, from rooftops, flooded areas, etc., has been impressive. Quantifying this role is difficult, although some measure of improved response time, or lives saved per dollar of rescue effort is possible. The same is true for increased police protection.

The use of rotorcraft for monitoring traffic has also played a role in easing traffic congestion through radio reports of road conditions on alternate routes, which are an aid to drivers. A measure of traffic flow, such as average speeds or volumes, or reduced minutes of delay

might be used to quantify such benefits, although numerous other factors enter into changes in traffic flow, and it might be difficult singling out the effects of aerial monitoring and reporting.

Similarly, aerial monitoring of air pollution and water pollution sources has helped trace, and in some cases, reduce or eliminate such sources through fines, etc.

Another area where quality of life can be improved is by providing access to recreational facilities, such as ski resorts, state parks, etc., particularly areas which are difficult to reach by ground transportation.

Reduction of travel times, such as between a CBD and an outlying airport, through the use of rotorcraft, also improves the quality of life, as does reducing the isolation of a community. In fact, some communities, such as in Alaska, depend on air transportation for their existence, with air service being their only supply source for food, medicine, etc. Various measures of accessibility, based on travel time and/or cost, can be assigned to a transportation facility or to an entire community, and this appears to be the most direct way of quantifying such benefits.

On the other hand, quality of life can be adversely affected by noise and air pollution, and intrusion of heliports and airports on community land. Land values adjacent to facilities may be affected, zoning may change, traffic congestion near airports could develop, along with commercial development, etc.

An important issue brought out by planners is the need to develop a benefit/cost analysis technique which can assess and evaluate these various factors. A planner should be able to assess air transportation systems options fully including due attention to effects on environment and quality of life.

Survey questions EII.1-7 dealt with impacts on quality of life from rotorcraft and commuter air operations. Questions EII.1, 3 and 4 were previously discussed (police, fire rescue; reducing fuel consumption; environmental impact). Results for EII.2, 5 and 6 are shown below:

What are the best ways of quantifying potential improvements to traffic and environmental monitoring? (EII.2)

Improved traffic flow	72%
Better traffic enforcement	35%
Emission reductions	32%
Other	5%

What are the best ways of measuring the impact of accidents on the community? (EII.5)

Property damage	44%
Lives lost	55%
Insurance costs	30%
Community concern, reduced business	25%
Other	6%

What potential benefits are there to elderly/handicapped passengers from rotorcraft/commuter air transportation? (EII.6)

Increased mobility	31%
Emergency health service	92%
Other	7%

Helicopters are perceived as being quite effective in monitoring traffic and helping to improve the flow of peak period traffic, thus reducing emissions. Helicopters are also being used in some areas to monitor sources of pollution, and for traffic enforcement.

The impact of aviation accidents can be measured in several ways, most importantly in terms of lives lost, property damage and insurance

costs. Planners can most readily compare aviation accident rates with other modes when they are expressed in terms of accidents per passenger mile.

Emergency health service is an important benefit to all citizens, and helicopters can provide quick transportation to hospitals and other emergency facilities. Measures of the life saving potential of such transportation are of substantial interest to planners.

Limited Fuel Environment

Planners feel that they do not have enough information on fuel consumption rates for rotorcraft and commuter aircraft to be able to compare them to other aircraft and to ground transportation. However, these data do exist, and planners should be made more aware of the stage lengths and fuel consumption rates of the latest rotorcraft and commuter aircraft. This is an area where manufacturers and operators can work together with planners to everyone's mutual benefit.

In answer to Question EII.3, planners show uncertainty in terms of what missions could potentially reduce fuel consumption compared to other modes. There was some feeling that in specialized activities, such as construction, or providing access to off-shore drilling operations, rotorcraft might be cost-effective from a fuel-use point of view. Also, some planners feel that because of the directness of flight paths, and accessibility from a central business district, transportation among CBDs which are relatively closely spaced (such as in the Northeast Corridor), and from CBDs to airports, might be missions which could save fuel compared to other modes. For commuter aircraft, there is more certainty that transportation among small cities, for distances up to several hundred miles, would be more fuel-efficient using smaller commuter aircraft than larger long distance commercial aircraft, particularly in lower density markets. Planners desire more information on this subject.

Fuel costs have risen from about 10% of total operating costs to about 33% since 1973, for all airlines. However, actual fuel consumption went down in 1980 compared to 1979. Projections are that jet fuel will remain available, although at higher prices.[1/] This will prompt all airlines to become as efficient as possible, including purchase of more efficient planes, and allowing short-haul traffic to be handled by commuter and rotorcraft operations.

Interfacing With Other Modes

As has been described, the ability to connect smaller cities with commercial flights at hub airports in large cities, and to provide access from central city transportation (taxis, local transit, intercity rail and bus, and even water transportation) to airports via STOL or rotorcraft is an important benefit. This was highlighted by the fact that respondents select "inter-modal connections" as the most important service factor for rotorcraft (Question EI.1) and second most important factor for commuter air. And, on Question CIII.1, airport/heliport location, ground access and distance from CBD were prime responses, implicitly related to connections with other modes.

A number of respondents were concerned with design of terminal facilities, both for passenger comfort and for efficiency of transfer among modes. Section B of the Questionnaire (Transportation Missions) shows that public transportation uses of rotorcraft, including inter-modal connections, are important now to 29% of respondents, but shows the sharpest increase in importance (up to 47%) projected for 1990. Commuter aircraft shows 73% (1980) and 76% (1990) importance, again strengthening the conclusion that inter-modal connections are among the major functions of rotorcraft and commuter aircraft.

1/"Jet Fuel: Will It Run Out?," OAG Frequent Flyer, July 1981.

Providing for convenient transferring among modes is an important factor in creating an overall integrated ground/air transportation system. Coordination of schedules, through-handling of baggage and ticketing of connecting modes, and properly designed terminal facilities will all attract increased ridership.

Other Assessment Parameters

Comfort and amenities aboard rotorcraft and commuter aircraft is another subject of interest to planners from the perspective of their effect on ridership and public acceptance. Aside from reliability in various weather conditions (discussed previously) the most frequent answer to question DI.8 is the problem of vibration in rotorcraft. Lack of roominess and seating comfort is the second most important concern for rotorcraft, and the most important for commuter aircraft. Pressurized and climate-controlled cabins are also quite important.

What passenger comfort/amenities (other than noise levels) require quantification?

	Rotorcraft	Commuter
Vibration	48%	26%
On-time/weather reliability	70%	41%
Space per passenger	39%	29%
Toilets	17%	14%
Seating comfort	39%	34%
Cabin temp., pressure	26%	29%
Other	17%	14%

For short rotorcraft flights, such as from a CBD to an airport, passenger amenities would not be as necessary as they would be on a longer flight, although the income level of passengers on these types of flights is probably fairly high, and a less spartan interior might help attract riders. Vibration, however, is a major concern and is a deterrent to ridership.

The same is true for commuter aircraft, and longer trips make increased comfort more of a necessity. Additionally, as the commuter airlines are providing connections to trunk airlines (including through-ticketing in some cases), less of a contrast in comfort level between the commuter vehicle and the commercial aircraft would help to generate ridership. Furthermore, enhancing the image of smaller aircraft as "sexy compacts," which the automotive industry has done successfully in the changeover to smaller cars, would be an excellent marketing strategy.

Conclusions and Recommendations

The futures of rotorcraft and commuter aviation are at an important turning point at the present time. Rotorcraft can continue to be viewed as specialty vehicles useful for transporting workers to off-shore drilling rigs, for monitoring traffic, or for emergency evacuation during floods or high-rise fires. Or, planners can take advantage of the specialized and unique operating characteristics of these aircraft in creating an integrated air transportation system serving local urban, as well as interurban transportation needs. Small communities have the ability to help shape their futures by fostering an efficient network of air passenger service among cities left without adequate service due to deregulation, and between such cities and the major hub cities served by commercial airlines.

For rotorcraft, planners are beginning to realize the potential public transportation roles which these vehicles can fulfill. With more knowledge of state-of-the-art rotorcraft and STOL technology, including such issues as safety and all-weather capability, ridability and comfort, fuel consumption and operating costs, planners would be able to determine appropriate market situations where rotorcraft and STOL could become economically viable transportation systems. Furthermore, planners could help educate the public as well as elected officials who constitute the critical lobbying and decision-making groups who will determine the future of rotorcraft and STOL in public transportation.

The commuter airline industry is in a situation where technology is beginning to respond to demand by producing a new generation of small aircraft capable of efficiently serving lower desity shorter haul markets. With deregulation, some cities have been left with lesser, or without any service, and have become isolated from one another and from hub cities. Other cities have been more fortunate in having achieved more frequent service, and more connections to other locations, as new commuter airlines have seized the opportunity to tap a relatively virgin market. The primary issue here is for planners to be equipped with the market analysis and forecasting techniques, as well as the economic and operating data on the state-of-the-art of commuter air technology, so as to be able to help plan, gain support for, and implement, an efficient, comprehensive network of commuter air routes.

Planners will have to work together with researchers, manufacturers and operators, as well as public groups and local, state and Federal officials, in order to accomplish these objectives. The following is a summary of planners' recommendations and comments (from Questionnaire Group F), ranked by frequency of comment:

For Researchers:

Number of Comments	
13	Determine markets for rotorcraft and commuter air; locate transportation-isolated communities in need of air service
13	Improve ride quality and amenities, pressurized cabins, reduce noise (in-vehicle and far-field), study rotor wash impacts, improve noise modeling, and develop standards for noise and community intrusion
7	Develop methodologies for quantifying costs, benefits and economic impacts on the community for rotorcraft and commuter air services, and for quantifying relationships between transportation accessibility (air and ground) and industrial growth
7	Improve fuel efficiency, use alternative fuels, and provide needed information on fuel consumption and operating costs

6	Improve safety, weather reliability, instrument guidance (micro-wave landing systems for commuter aircraft, instrument approaches to heliports, etc.)
5	Develop forecasting techniques for future demand (rotorcraft and commuter air) and need for new facilities
5	Determine time and/or cost savings potential for rotorcraft and commuter air compared to other modes (ground and air)
5	Determine demand threshold for economic feasibility, appropriate roles and missions, optimum trip lengths etc.
4	Collect needed data; pool all data and research findings including Defense Department research on advanced design
2	Better weather forecasting; predicting icing conditions
1	Design for higher crash survivability

For Manufacturers:

Number of Comments	
16	Reduce noise emissions and rotor slap for rotorcraft
15	Improve fuel efficiency; use of alternative fuels
8	Improve safety: instrument guidance, anti-collision and weather reliability
8	Reduce maintenance costs (especially for rotorcraft) and initial costs
5	Improve STOL capabilities to reduce runway lengths
4	Improve ridability, comfort; reduce vibration and instability
4	Improve image of rotorcraft and commuter aircraft; work with public agencies

For Operators:

Number of Comments	
9	Educate the public as to safety and benefits to community for rotorcraft and commuter air

7	Use marketing and promotions to enhance image and gain support for new services
7	Apply management techniques to reduce costs, minimize ground support and infrastructure
6	Provide economically sound service, stable fares and ridership; do not rely on subsidies; price what market will bear
4	Keep passenger data, origin-destination data; work with planners on what price the market will bear
4	Stricter operating rules, improve safety, better pilot training
3	Develop discrete helicopter air corridors, low altitude flight paths
2	Encourage further deregulation of airlines, provide service to small communities
2	Interface with ground modes and major air carriers; provide through-tickets including ground transportation
2	Demonstration projects of new services jointly with public agencies
1	Scrap glamour image of air transportation; market as a public transportation service like rail or bus to gain ridership

Miscellaneous:

Number of Comments	
1	Determine appropriate jurisdiction and responsibilities of various levels of government for air space regulation and control
1	Government should streamline the environmental review process
1	Train more helicopter pilots to avoid future shortage
1	Use highway interchange air rights for heliports; many small heliports needed in metropolitan areas, not just one main heliport

IV. INTEGRATED AIR AND GROUND TRANSPORTATION

This section assesses the requirements for integration of rotorcraft and commuter air transportation modes with one another, with long-haul air transportation and with ground transportation. A framework for planning to make more efficient use of aircraft and air facilities is presented. Opportunities and benefits of integration of modes are suggested.

Definitions

Until recently, air transportation planning has focused primarily on intercity commercial aviation. Rotorcraft operations, air-taxi and commuter air transportation have developed on a local, site-by-site basis, not being part of any overall master plan for air transportation. Thus the result has been duplication of service in some cases, total lack of needed service in other cases, use of aircraft inefficient or ill-suited for specific purposes, and lack of coordination among these various air services and with ground transportation (which may provide access to, or competition with, air transportation). Planners need an accurate description of the current situation as well as a planning framework for an overall integrated air and ground/air transportation system. A definition of such an integrated system should be helpful as a first step.

The terminology "integrated air transportation" refers to a balanced system of various types of air transportation services, all of which serve separate, but complementary, functions in providing service to all segments of the market: intraurban, interurban and international, passenger and freight.

The various components of an integrated air system may be stratified as follows:

LOCAL (intraurban)

- CBD to hub airport, and/or outlying commuter or reliever airport
- Airport to airport (within same metropolitan area)
- CBD to outlying industrial parks, office parks
- Suburban site to site (industrial, office, etc.)

INTERURBAN

- Large city (CBD) to small city
- Large city (hub airport) to small city
- City to city (CBD to CBD)
- City to city (hub airport to hub airport)

INTERNATIONAL

- International (port of entry) airport to foreign country

Within an integrated air system, trips originating or ending in a CBD could be made by rotorcraft or possibly STOL. Suburban and short distance trips among airports could be made by rotorcraft, STOL, commuter aircraft or commercial aircraft, depending upon actual distances, passenger volumes, load factors, and operating costs (primarily fuel consumption) of the vehicles. Long haul interurban and international trips would be made by larger commercial aircraft.

Access and Modal Interface Requirements

One of the prime requisites of an integrated air transportation system is access to the various components. This includes:

- Point of origin of the trip to the initial air mode (by ground transportation)
- Transferring from one air mode to another, if necessary
- Access from final air mode to destination

Access and interface elements of the linkages between the various modes include the following:

FACILITY	ACCESS
CBD Heliport or STOL port	Elevator, stairs, escalators, taxi/limo, transit, auto
Large City Hub Airport (and International)	Rotorcraft, STOL, transit, auto, taxi/limo from CBD and surrounding communities
	Rotorcraft, STOL, commuter aircraft, small commercial aircraft, auto, taxi/limo, transit, among hub airports in same metro area; large commercial aircraft from other hub and overseas airports
Reliever and Commuter Airports	Rotorcraft, STOL, commuter aircraft, general aviation from other reliever and commuter airports, and from hub airports; auto, taxi/limo public transportation from surrounding areas

For transportation systems to work effectively, adequate access, as well as convenient transfer among modes, has to be provided at all facilities. The following modal interface requirements apply to the various situations:

- CBD Heliport or STOL port
  - Safe, easy pedestrian access
  - Adequate parking
  - Adequate drop-off areas for autos, taxis, limos, and buses and waiting areas for pick-up
  - Comfortable terminal facilities including ticketing, waiting, restroom, and baggage handling facilities (where appropriate)
  - Provision for elderly and handicapped passengers
- Large City Hub Airports
  - Adequate traffic capacity and informational signing on access roads

- Adequate long and short term parking, with access to terminals
- Adequate drop-off areas for auto, taxi/limo and bus, and waiting areas for pick-ups
- Provision for safe pedestrian movement from parking and drop-off areas, transit stops, and among terminals
- Ideally, commuter air and/or STOL and rotorcraft terminal facilities will be located adjacent, or as close as possible, to commercial airline facilities to ease transfer
- Preferably, unified through-ticketing[1/] and baggage handling among modes would greatly ease inconvenience of transferring
- Informational displays and signing in terminals for ease of transferring; comfortable waiting areas
- Provision for elderly and handicapped passengers

• Commuter Airports

- Adequate capacity on access roads
- Adequate long and short-term parking, drop-off and pick-up areas for auto, taxi/limo, bus
- Safe pedestrian facilities from parking areas
- Rotorcraft and STOL facilities located adjacent or close to commuter air for ease of transfer
- Unified ticketing and baggage handling
- Comfortable terminal waiting area
- Provision for elderly and handicapped passengers

• Freight Operations

- At all airports, adequate access roads for trucks, rail spurs, loading/unloading and modal transfer facilities, and secure storage areas are required.
- Freight operations should not interfere with passenger operations.

[1/]Joint fares and baggage handling are mandatory for commuter airlines interfacing with commercial airlines, under the Airline Deregulation Act of 1978; see the 1980 Annual Report, Commuter Airline Industry

Planning Framework

Ground transportation not only provides access to air transportation facilities, but also represents a competing mode.[1/] For short trips in urban areas, such as from CBD to airport, or among several airports within the same metropolitan area (e.g., Newark, JFK and La Guardia in N.Y.C.) or CBD to suburban office/industrial sites, auto, taxi, limo and public transit all represent competition for rotorcraft. In periods of peak traffic congestion, rotorcraft would have the distinct advantage of time savings, while trip costs may or may not be higher for rotorcraft, depending upon through-ticket discount arrangements with connecting airlines, and other factors. Future advances in rotorcraft technology such as larger, more fuel efficient craft, will help reduce operating costs per passenger mile,[2/] and make rotorcraft even more competitive with ground transportation.

For interurban transportation, auto, bus and rail are all competitive modes with air travel for closely spaced cities. Such modal choice parameters as convenience and accessibility of the private auto, location of, and access to, airports, comfort level, cost and travel time, all play a role in passenger decision-making. In some markets, such as the Northeast Corridor, the differences in travel times and costs between air and ground transportation are small and much competition among modes exists. In other regions, such as the larger Western states, air transportation is a more dominant intercity mode because of the great distances between cities and the low density of intermediate destinations. Geographic constraints make ground transportation circuitous and impractical in many cases.

1/ In 1979, 87% of scheduled commuter air flights were 250 miles or less. 1980 Annual Report, Commuter Airline Industry.

2/ "Future Rotorcraft and Short-Haul Airplane Transportation Opportunities," unpublished paper by Jay Christensen, Louis Williams, NASA-Ames Research Center, May 1979.

Before deregulation, there was much duplication of air service among major hub cities, with numerous airlines competing for the same profitable markets (which helped support service on unprofitable routes). With deregulation, new airlines have entered the major markets, adding to the competition (in some cases helping to drive fares down), older airlines have dropped unprofitable city pairs, and commuter airlines with smaller, more efficient planes have helped take up the slack (with the help of subsidies in some cases).[1/] While smaller cities are eligible for subsidized service, and larger cities provide profitable routes, medium sized cities may end up with little or no service.[2]

The Essential Air Service program, under the Deregulation Act of 1978, provides for continued air service for 10 years to certain specified small and medium sized cities. Out of 555 communities which were initially eligible for the program, 319 were approved by the CAB, based on location relative to hub airports, previous number of flights and passengers to nearby hubs, existence of intercity ground transportation alternatives, and other factors. At least two round trips per day to the specified hub airport are required, and are subsidized where necessary. Any appropriate certifed type of aircraft may be used. While this program has helped maintain at least mininal service in many communities, other small communities did lose all service after deregulation.

Existing conditions demonstrate some of the problems resulting from the lack of a rational, nationwide transportation plan. While deregulation has helped the airlines adjust somewhat to market conditions, there is a great need for a nationwide transportation plan which would integrate all modes of air and ground transportation and provide an energy-efficient system serving all markets

---

1/In 1979, commuter airlines replaced vacating commercial airline service in forty-six communities. 1980 Annual Report, Commuter Airline Industry.

2/"Many Smaller Airports Stand to Lose More Flights With More Deregulation," N.Y. Times, Sunday, May 8, 1981.

without unnecessary duplication. The parameters which must be examined in order to analyze each mode relative to other modes, from a cost/benefit perspective, include:

- Speeds, travel times, for each mode and performance characteristics of vehicles
- Productivity and passenger-miles per dollar of operating cost (fuel, wages, seating and load factors of vehicles, maintenance costs, etc.)
- Comfort level (noise, vibrations, amenities)
- Accessibility of modes, door-to-door total travel time, location of facilities relative to users
- Convenience of modal transferring where necessary (ease of transfer, through-ticketing, baggage handling, waiting times, etc.)
- Coordination of schedules among modes
- Geographic constraints to particular modes
- Legal and regulatory issues concerning operations, routing and scheduling
- Economies of operations, revenues and costs, subsidies, capital grants, etc.
- Environmental considerations
- Safety issues

While much of these data are known for other modes, planners may not be aware of some of the needed information for rotorcraft or commuter air. Such documents as the 1980 Annual Report: Commuter Airline Industry are helpful in providing data on airlines, airports, communities served, vehicle type and performance. Similar information exists for rotorcraft. When planners are more familiar with these data and the missions or roles which can best be accomplished by these modes, they will be better equipped to plan a more integrated ground/air transportation system.

Examples of Considerations in Integrating Systems

Two examples will help illustrate the various services which should be components of an integrated system for a large urban region (New York) and a small isolated community (St. George, Utah).

Air Transportation System in New York City Region

The New York City region provides an example of the various levels of air service, ranging from CBD to airport via helicopter, to international air carrier service. The region, encompassing New York City, northern New Jersey, southern Connecticut, and southern New York State, (roughly 19 million population) is served by three major air carrier airports (Kennedy, Newark and LaGuardia), the first two of which are international. In addition, a number of other air carrier airports serve the outlying sections of the region (Morristown, Trenton, and Monmouth in New Jersey; Islip on Long Island; Hartford in Connecticut, and Westchester and Stewart in southern New York State).

Ten U.S. trunk carriers (domestic and international), four local service air carriers, and six all-cargo carriers serve the region, and about twenty-five commuter air carriers provide trips among smaller cities in the region. Service to nearby large cities, such as Albany, Syracuse, Boston, Philadelphia, and Washington, D.C., is available from many of the outlying airports, either by trunk, local service, or commuter air carriers, and similarly, service exists from some of the outlying airports to the three major airports. For example, Command Airways provides frequent flights between Poughkeepsie and both JFK and LaGuardia, and Air Vectors flies twice a day to Newark.

Commuter air carriers, which use both the major and outlying airports, serve many smaller communities in the region, using airports at Poughkeepsie, New Haven, Waterbury-Oxford, Bridgeport, East Hampton, Essex County, Princeton, Atlantic City and others.

In addition, there are several specifically designated "reliever" airports for general aviation in the region.

There are also flights between pairs of some of the outlying airports, and in some cases, betweeen Manhattan heliports and the airports.

New York Helicopter Corp. has frequent flights among Newark, JFK and LaGuardia airports, as well as between the East 34th Street Heliport and the three airports (using Aerospatiale Dauphin 360 single-engine helicopters). Trans-New York Airways provides helicopter service among the three airports and from the Wall Street Heliport (using Twin-engine Augusta 109 A's).

In 1977, the region's airports accounted for some 8% of domestic and 50% of international airline passengers in the U.S.[1/]

Six all-cargo commuter airlines serve the New York region, and several passenger commuter airlines also provide air cargo and express package services.

At the international level, some forty-five foreign flag carriers provide scheduled service to Kennedy and Newark (any type of existing commercial aircraft can land at JFK, and non-stop flights travel as far as Tokyo, 6,800 miles away).

In terms of ground access to the airports, subway/bus service is available from Manhattan and Downtown Brooklyn to JFK, and from Manhattan and parts of New Jersey to Newark Airport. LaGuardia can also be reached by subway and local bus. Auto, taxi, bus and limousine provide other modes of access to these airports. The other airports in the region are most easily accessed by auto, with some service available by limo or taxi. A commuter rail/taxi trip is also feasible to some of the outlying airports.

[1/] Aviation Monograph, April 1979, Port Authority of N.Y. and N.J.

Each component of an integrated air and ground/air transportation system exists in the New York region. However, major improvements are still needed. Market research should be used to determine the feasibility of helicopter or STOL service from Manhattan to smaller communities and industrial/office parks in the region, and to CBDs of the neighboring large cities (Albany, Hartford, Boston, Philadelphia, Baltimore, Washington, D.C., etc.) to eliminate the necessity of first getting to an airport and then making the connecting flight or using ground transportation for the entire trip. Additional flights from the smaller communities in the region to the three hub airports would provide easier access to U.S. trunk and overseas carriers, and could reduce ground access congestion. Better coordination of schedules among these various layers of service, provision of better ground access to the airports, and provisions for easier transfer from one mode to another at the airport terminals, would all help provide a more integrated system.

Air Transportation in St. George, Utah

St. George is a town of 7,100 people, located in the southwestern corner of the State, 300 miles from Salt Lake City, which is the air hub of Utah. Las Vegas is 150 miles to the southwest, and Phoenix is about 300 miles south of St. George.

Sky West Aviation provides commuter service to St. George connecting it to the hubs of Salt Lake City, Las Vegas and Phoenix. There are also flights to nearby Cedar City, Utah; Page, Arizona; and Flagstaff, Arizona (all of which are included under the "Essential Air Service" program). Access to the trunk airlines requires a flight from St. George to one of the three hubs, and flying to other locations in Utah, such as Logan or Vernal, requires a flight to Salt Lake City and a second commuter flight on Trans-Western or Frontier Airlines.

Almost all access to these airports is by auto, except that a limited amount of taxi service is available at St. George and some of the other small communities. Air taxi, rental cars and limousine service are

available at some of the hubs, but not all of them. Virtually no ground mass transportation service is available.

Thus, St. George represents the opposite end of the spectrum from the New York City region, with only five daily commuter flights to Salt Lake City (via Cedar City), four to Las Vegas, and two to Page, Flagstaff and Phoenix. There are connections via other commuter or local service carriers at the hubs to a very limited number of small cities in the state and surrounding areas. With the small number of flights into the hubs, connections to trunk airlines and national and international flights requires much waiting time at the hub airport. However, distances of several hundred miles makes ground transportation too time consuming for many travelers.

Since deregulation, a number of small cities in Utah, such as Moab or Richfield, have been dropped from service. Only Cedar City and Vernal are on the list of "Essential Air Service" cities, which were guaranteed some service for ten years. To integrate air transportation in an expansive state such as Utah, the transportation needs of each of the communities, and various sectors of the State's economy, must be evaluated, and a determination made as to the most efficient modes and types of vehicles needed to meet those needs, whether it be rotorcraft, commuter air, or ground transportation.

Survey Results

Several questions in the survey dealt with the issue of integrated air transportation. Responses to questions in Group B (transportation missions) show that the public transportation role of commuter airlines (linking small cities with one another and with major hub airports) is considered quite important by planners, and similar roles for rotorcraft (including CBD to airports and to other CBDs) were projected to gain greatly in importance in the next ten years (see Table 3).

Question CII.1 (ground access) addresses one of the fourteen most important issues, with parameters of travel time and congestion being of major importance, thus indicating a need for better access to airports, such as by rotorcraft. Planners also expressed the opinion that excess waiting time and difficulty in transferring from mode to mode were serious impediments to an integrated system.

Question III.1 (airport/heliport location) dealt with the highest rated issue, and the responses showed great concern for ground access to heliports and airports, and locational parameters such as distance from CBD.

Responses to question EI.1 (service factors) showed that planners place importance on the role of rotorcraft in intermodal connections, but that for commuter aviation they place roughly equal importance on its role in intermodal connections and linking of communities. Survey results show a desire by planners to overcome the obstacles, such as inaccessibility and difficulty of transfer, and to better utilize rotorcraft and commuter aircraft in creating a comprehensive, integrated air transportation system.

Conclusions and Recommendations

Each of the various sizes and types of communities have their own transportation needs, some of which can be fulfilled by air transportation. Historically, the majority of commercial air transportation has been oriented towards trunk routes among the medium and larger cities, with a relatively small number of commuter airlines connecting smaller cities to the hubs. With deregulation, many cities were left without service. As new commuter airlines have taken up the slack in many instances, and have begun to create new markets, the need has arisen for planners to help unify what is a patchwork of various types of services. Route structures, fares, and schedules should be rationalized. The different levels of air transportation serving

different segments of the market, and various air and ground modes providing access and connections, as well as competition, should be unified into an integrated system, much as the highway system provides for local and collector routes tying into arterials, which in turn link Interstate highways. The needs of each type of community and the various market segments must be studied, and the most efficient types of vehicles developed for meeting these needs. Goals should be set which would define the roles air transportation will have in the local, regional and nationwide transportation system. In this way, a clear picture will develop as to the direction which rotorcraft and commuter air planning should take.

Recommendations

- Gather and disseminate pertinent information on rotorcraft and commuter air technology, performance, operating costs, etc.[1/]
- Determine which vehicles (existing or proposed) would be most appropriate and cost-effective for the various types of service (missions)
- Study travel patterns of different types of travelers, and the transportation needs of different types of communities, as well as various types of corporate, commercial and industrial activities, to define the various market segments and their transportation requirements
- Study potential benefits of improved integrated ground/air transportation (time savings, economic base, safety, etc.) on various types of communities and businesses, and quality of life
- Perform benefit/cost analyses to determine most beneficial and cost-effective assignment of modes and vehicles for creating an integrated system
- Educate the public and officials (decision-makers) and gain support for implementation (planning, approval, funding) of an integrated system

---

1/ In 1980, the CAB began processing commuter airline financial and reliability data. 1980 Annual Report, Commuter Airline Industry.

V. LEGAL AND REGULATORY REQUIREMENTS

This section summarizes the roles and responsibilities for rotorcraft and fixed wing commuter aircraft at different levels of government. The primary focus is on heliport regulation by states and local areas. The major provisions and technical standards of representative local heliport ordinances are compared and key issues are discussed. There is an urgent need for all levels of government and the private sector to take action, if the growing number of heliport ordinances is to remain in the public interest.

Overview of Federal, State and Local Responsibilities

Federal, state and local governments are involved in most types of new helicopter and commuter air facilities, or changes to existing facilities. While the Federal government's roles and responsibilities are clearly defined and limited, the participation of state and local government varies widely, especially concerning heliports.

Federal

The Federal government, through the responsibilities assigned to the Federal Aviation Administrator under the Federal Aviation Act of 1958, controls the following areas of aviation in the United States:

- Airspace use and management
- Air traffic control
- Safety
- Regulation of aircraft noise at its source

The FAA exercises control in these areas by issuing Federal Aviation Regulations (FAR), and Advisory Circulars (AC), which serve as mandatory and voluntary guidelines to states, local governments and the private

sector. Through its decisions to fund particular projects under the Airport and Airway Development Act of 1970, the FAA has been able, to a degree, to influence the development of new facilities. The national, state and local continuous planning process conducted pursuant to this Act results in the periodically updated National Airport System Plan (NASP), which is the principal mechanism for channeling Federal funding.

Since many fixed wing commuter aircraft facilities are Federally funded, the policies contained in the NASP are important to this mode. For heliports, the Federal role is limited. Few heliports are included in the NASP, so most financial and planning decisions are made by state and local government and the private sector. Federal responsibility for heliport development involves airspace, safety and environmental approvals, including:

- FAA Form 7480-1, Notice of Landing Area Proposal, which must be submitted with a sketch proposal and map 90 days before construction
- FAA Form 7460-1, Notice of Proposed Construction or Alteration, which must be submitted at least 30 days before construction or application for a building permit
- For Federally assisted heliports an EIS is required pursuant to the National Environmental Policy Act of 1969. FAA has responsibility for airport noise standards. However, the term "airport" as used in New Part 150 does not include those airports used exclusively by helicopters.1/

FAA airspace approval is a prerequisite for state and local approvals, but does not affect the number or type of subsequent approvals required under state or local law. Other than issuing a heliport design guide and a model zoning ordinance to limit the height of objects around

---

1/"Establishment of New Part 150" Federal Register, Vol. 46, No. 16, January 26, 1981, 8316.

airports,[1] FAA has not addressed the content or impacts of local laws and regulations on heliport or commuter air facility development.

State and Local

State and local roles and responsibilities for helicopter and commuter air facilities are fragmented, often unclear and sometimes controversial. This situation will probably impede rather than facilitate the options and potential benefits of these modes in the future.

Many states have an aeronautics board which is responsible for all types of aviation facilities and operations. Generally these boards and their staffs have responsibility for some or all of the following activities:

- Statewide airport system and air service planning
- Technical assistance to local areas and operators
- Administraton of financial grants
- Promulgation of rules and regulations
- Licensing and inspection

Prior to the Airline Deregulation Act of 1978 (P.L. 95-504), some states conducted economic regulation of intrastate air operations, as well as the intrastate portion of interstate flights.

Importantly, states are responsible for defining the extent of aviation regulatory powers and authority at the local level by state enabling legislation. Such legislation varies from state to state, but often provides for planning, zoning, building, fire and environmental codes, permits and procedures by a wide range of different local

[1] Heliport Design Guide, Advisory Circular No. 150/5390-1B, Federal Aviation Administration, August 22, 1977, and A Model Zoning Ordinance to Limit Height of Objects Around Airports, Advisory Circular No. 150/5190-4, Federal Aviation Administration, August 23, 1977.

jurisdictions, including metropolitan planning commissions, counties, cities and towns.

Depending on the type and extent of enabling legislation, some localities such as large cities may have exclusive control over aviation permits, facilities and operations. Other areas, such as suburban towns and rural communities usually exercise zoning controls, but defer to state permit procedures and facility regulations. Occasionally, state or local government are themselves airport operators and therefore exercise additional control over helicopter and commuter air facilities and operations.

Most local areas have specific ordinances for airports, and some are coordinated with state and regional airport land use and development plans.[1/] Although relatively few local areas have ordinances governing the establishment and operations of heliports, the number of such ordinances is growing rapidly, without the benefit of either plans or technical guidelines.

State and local regulation of heliports is an important and sometimes controversial factor in the future growth of this mode. Issues such as public vs. private use facilities, state vs. local control, and the need for regional vs. local ordinances are emerging in some areas of the country. Their implications should be addressed at the national level as well.

Helicopter Ordinances

Many localities are, or may soon be, confronted with proposals for helicopter services and facilities. Most areas do not have plans or policies for integrating these proposals with other ground and air transportation modes. As a result, such proposals usually generate

---

1/Airport Land Use Commission Policy Plan, Sacramento Regional Area Planning Commission, June 1975.

immediate action by local officials to adopt ordinances which are often either unnecessarily restrictive or fail to adequately address the legitimate public safety, welfare, environmental and transportation concerns of the local community. Some of the important issues concerning local helicopter ordinances are:

1. When and where is a helicopter ordinance necessary?
2. If an ordinance is appropriate, what kind of ordinance should be developed and by whom?
3. What provisions should an ordinance contain and what are the appropriate technical standards?
4. Can local ordinances be developed that relate to transportation system plans and are consistent across jurisdictional lines?

For many areas, especially small towns and rural communities, helicopter ordinances may not be the answer. For other areas, such as suburban, urban and large metropolitan areas where helicopter demand may increase substantially during the 1980s, piecemeal or comprehensive ordinances either exist or are being proposed. The geographic, economic and demographic diversity among these areas are some of the legitimate reasons why the nature and content of local ordinances should vary. However, some provisions are likely to be similar among most ordinances. Of major concern is the type and range of technical standards, if any, that are included in local ordinances and their relation to rapidly changing aircraft technology. Finally, aircraft specific ordinances run the risk of being inconsistent with transportation plans and alternatives, and may create operational obstacles because of lack of commonality among local communities.

Comparison of Major Provisions

Figure 1 shows a comparison of the major provisions of helicopter facility ordinances enacted by five large urban areas across the nation. Several other ordinances from suburban and small urban areas were also

FIGURE 1

COMPARISON OF MAJOR PROVISIONS OF LOCAL HELICOPTER FACILITY ORDINANCES

Area	Type of Ordinance	Facility Classification	Permit Required Local/State	Permit Fee Schedule/ Duration	Approval Period	Required Application Content	Emergency Rooftop Access Requirement	Periodic Inspections	Revocation Procecure	Penalty for Violation of Ordinance
New York, NY	Piecemeal; reliance on administrative requirements	Public/ Private	yes/no	none/annual	Extensive Public hearing process for public use facilities	Content specified by lead review agency	none			
Chicago, Ill.	Comprehensive	Based on aircraft weight	yes/	$100/annual	none specified	Description of property; Plans and specifications; ingress and egress route map	All new buildings over 80 ft high; 50 ft. diameter clear area	yes	yes	not less than $50 nor more than $200 per offense
Los Angeles, Calif.	Piecemeal; reliance on administrative requirements	Based on facility use and dimensions of aircraft	yes/yes	$64/annual	Planning Commission and Fire Dept. hearings and reviews	Content specified by review agencies	All bldgs, over 75 ft. 100 x 100 ft clear area	yes		$160 for landing at unauthorized facility
Houston, Tex.	Comprehensive	Public/ Private	yes/	$100 public/ annual $50 private/ annual	Temporary Permit in 5 days; Final approval in 60 days	Description of location layout; operation; public need; and public interest	none	yes	yes	$100 per day until violation is corrected
Denver, Col.	Few controls or standards	Based on aircraft weight	yes/no	By class of facility I $25/annual II $50/annual III $75/annual	none specified	Engineering report; statement by Bldg. Dept.; operations statement; site plan	none	none	none	none

reviewed. Blank spaces in Figure 1 indicate that the provision was not specifically addressed in the portion of the codes that were available for this analysis. (It is possible that other ordinances in a city's code cover some of the missing items.) A discussion of each of the major provisions, as well as other possible provisions not generally found in most ordinances, is presented below:

Major Provision	Definition and Discussion
Type of Ordinance	Helicopter ordinances are either piecemeal (i.e., specific provisions added to existing sections of a municipal code such as zoning, fire, building, and franchises) or comprehensive (i.e., all or most of the relevant provisions in one section of the code). The comprehensive ordinances varied in scope and level of detail. The piecemeal ordinances relied on rather thorough written requirements and procedures established by the city agency responsible for issuing the heliport permit.
Facility Classification	Local areas have a variety of heliport facility definitions and classification schemes ranging from the broad to the specific. Some of the most common definitions are: • Public Use Facility: Open for use to any helicopter capable of using the facility regardless of ownership or control. Public use facilities constructed with public funds are sometimes given preferential treatment or placed in a preferred class. In other cases, they might be discouraged in favor of greater reliance on privately funded and operated facilities. • Private Use Facility: Owned or controlled by the owner or occupant of the premises for the exclusive use of the owner occupant, his guests or patrons. • Heliport: An area, either at ground level or elevated on a structure, used for the landing and takeoff by helicopter.

- Helistop: Any area used for the landing and takeoff of helicopters, but does not afford refueling, maintenance, repair or other facilities and is for the accommodation of a single helicopter

- Helipad: Sometimes used synonomously with helistop

- Emergency Landing Areas: Refers to areas within the approach zone of a helicopter facility which can be used for emergency landings, and to rooftops and other areas for temporary or occasional helicopter use such as evacuation, but not formally designated as a heliport or helistop.

- Emergency: Includes rescue and ambulance missions, and other flights of unexpected and emergency nature.

Helicopter facilities are often classified according to one or more categories (Class I, II or III). These categories are usually differentiated by some, but not all, of the following technical standards:

- Use: Private, Public (small), Public (large)

- Gross Weight of Aircraft

- Geometrics of Landing Area

- Approach and Departure Paths

Helicopter facilities are sometimes further subclassified according to their available support facilities as follows:

Subclass A - Minimum support facilities - no buildings, maintenance or refueling.

Subclass B - Limited support facilities - no maintenance or refueling

Subclass C - Complete support facilities including maintenance and fueling

Permit Required Local/State

Most large urban areas require a permit for helicopter facilities, approved and issued by an appropriate municipal review agency and sometimes approved by the city council and/or the mayor. Since most large urban areas have state enabling legislation which allow them to promulgate aircraft facility regulations, subsequent review and approval by a state aeronautics agency, or issuance of a state level permit in lieu of a local area permit, is usually not required.

Suburban and medium size urban areas which rely principally on zoning ordinances for control of helicopter facilities, usually issue conditional or tentative permits which are subject to final review and approval at the state level. In these areas, the weight of responsibility usually rests with the state aeronautics board, rather than the local jurisdiction.

More often than not small urban and rural areas have no local permit requirements. Helicopter facility applications are generally submitted directly to the appropriate state agency.

Permit Fee Schedule/ Duration

A wide range of practices are followed including no fees, flat fees, and fees differentiated by facility classification such as public, private or weight classes. Both fees and permit renewals are usually on an annual basis.

Approval Period

Some local ordinances contain specific review and approval periods for heliport permits as well as provision for temporary permits pending final disposition of the review and approval process. For example, Houston has a 60 day review and approval period subject to the receipt of FAA airspace approval of the facility within that period. A temporary 30 day permit can be issued after only 5 days.

In New York City, which has no specified review and approval periods for helicopter facility permits, experience has demonstrated that public use heliport

permits require 14 to 18 months, while private use permits may average 2-3 weeks.[1]

Required Application Content

Most ordinances specify the type of information that must be submitted as part of a heliport permit applicaton. In addition, some ordinances identify qualitative or technical standards that must be applied by the review agency for approval of the application.

Where the application content is not specified, the agency responsible for issuing the permit generally has a list of information requirements that are available upon request to the applicant. In such cases, approval standards are sometimes based on broad public policy decisions, or immediate public and political issues. In other instances, formal requirements and minimum design standards may have been developed by the agency. In small urban and rural areas, application content is based on information requirements and approval standards developed at the state level.

The following list presents the information categories identified in the ordinances from large urban areas. No ordinance required all these categories. Approval of the application is usually contingent upon the simultaneous application and approval of an FAA airspace request. Copies of the local and FAA applications are sometimes required to be filed with the fire commissioner, police commissioner and state aeronautics agency.

- Proof of financial responsibility, experience and general fitness of the applicant
- Evidence that proposed site is unencumbered by deed, operating or use restrictions
- Site plan which may include:

---

[1]/Phone conversation with William Benton, Director of Aviation, New York City Bureau of Ferry and General Aviation Operations.

- -- description of property
- -- intended size, layout and specifications
- -- conformance with zoning

- Operations plan which may include:

  - -- intended uses of facility and types of operations
  - -- intended routes of ingress and egress
  - -- intended emergency landing areas
  - -- description of the relationship of the facility to established airports, heliports and helistops
  - -- description of the relationship of the facility to existing air facility, air services or other plans
  - -- expansion plans
  - -- effects on noise, light
  - -- effects of fuel shortages

- Statement on public need for the facility

- Structure report by a registered engineer, if the proposed facility is on a rooftop

- Statement of compliance with building code, approved by building department

- List of aircraft registration numbers and pilot names

- Verification of insurance

- Listing of all public safety features

- Documentation indicating compliance with state and local environmental laws

Emergency Rooftop Access Requirement

The rash of hotel fires during the last year have demonstrated the effectiveness of emergency rooftop evacuation by helicopter. Local ordinances vary widely on this provision, from no requirement, to voluntary facilities on all buildings, to mandatory requirements for all new buildings above a minimum height (75-80 ft.), with required rooftop clear area and fire code and design specifications. A key issue surrounding this provision is who is in charge during an emergency (fire department, police department, medical evacuation team).

Periodic Inspections — Periodic inspections of the facility by the responsible public agency are often authorized in the ordinance to see that all requirements of the permit are complied with.

Revocation Procedure — Several ordinances specify a procedure to be followed in order to suspend or revoke a permit. The revocation may include: an investigation by the responsible public agency, written notice to show cause within 5 days, hearing, and/or determination by the mayor or appropriate public official. Grounds for revoking a permit include:

- Alteration of the physical profile of the area surrounding the heliport renders it unsafe
- Failure to comply with the terms of the ordinance and/or permit
- Violation of the permit holder of any state or local laws

Penalty for Violation of Ordinance — Ordinances without specific penalties for violations are considerably more difficult to enforce than those with delineated penalties. At the same time enforcement requires adequate personnel, and sometimes instrumentation. Penalities contained in existing ordinances range from none, to revocation of permit. Various levels of monetary fines are usually stipulated for individual violations including landings at unauthorized facilities, from $50 to $250 per offense or $100 per day until the violation is corrected.

Other Possible Provisions

In addition to the major provisions common to many helicopter facility ordinances, some ordinances contain additional guidelines or requirements which may be unique to the area, or provide desired levels of detail or clarification. Some of these are briefly summarized below:

Appeal Procedure — If a permit is denied, suspended or revoked, an ordinance may contain a specific appeal procedure designed to expedite the rights of the applicant

	or permit holders. This procedure would include time limits and defined responsibilities for public officials.
Authorization for Rules and Regulations	A local ordinance may include, subject to state enabling legislation, authorization to establish and promulgate rules and regulations in connection with helicopter facilities designed to safeguard the public. In addition to those already identified, such rules and regulations may include provisions for: • Control and prevention of fire hazards • Storage of flammable liquids • Prevention of traffic congestion at heliports
Applicability/ Non-applicability Clause	Does the ordinance apply to all existing facilities and operations or to new facilities and operations only? Some ordinances exempt Federal, state and municipal governments or agencies from all provisions.
Non-liability of City	Provision which states that the city shall not be liable for any personal injuries or property damages in connection with the construction, establishment, maintenance or operation of any helicopter facility for which a local permit has been issued.

Comparison of Technical Standards

Depending on the ordinance, qualitative and quantitative standards or criteria are sometimes provided for approval of a helicopter facility permit application. Overall, these standards are usually based on FAA technical circulars, National Fire Protection Association (NFPA) guidelines, state aeronautical board specifications, and local building, zoning and fire code specifications and procedures. Figure 2 shows the major categories for which technical standards are sometimes provided. A brief discussion of each category follows:

FIGURE 2

COMPARISON OF MINIMUM STANDARDS FOR LOCAL HELICOPTER FACILITIES

Area	Layout Design and Construction	Location	Hours of Operation	Insurance	Safety	Environmental
New York, NY	none specified	As a matter of policy no rooftop facilities approved; waterfront and riverfront locations only	none specified	Insurance verification required		Noise ordinance; City air quality review procedure
Chicago, Ill.		Approach and lateral clearance zones; emergency landing areas, other specifications. 2000 feet from non-conforming zones	none specified	Liability: $100,000/person $1 million/accident Property damage: $1 million/accident	Building and fire codes	none specified
Los Angeles, Calif.		none		Liability $2.5 million	Fire Dept. requirements	Effects on noise; Compliance with state environmental law
Houston, Tex.	No technical standards in ordinance. Reliance on FAA circulars and NFPA guidelines, and lead review agency criteria		none specified	Non-liability of City	Building code	Effects on noise and light must be considered
Denver, Col.	Rooftop helistops only		none specified	Sufficient to protect public welfare	Detailed fire code welfare	none specified

Technical Standard	Definition and Discussion
Layout, Design and Construction	FAA Advisory Circular 150/5390-IB, provides a basic heliport design guide for ground based equipment which is referenced by some ordinances. The State of Louisiana DOT has published an offshore heliport design guide for constructing operational helistops or heliports in coastal marsh areas, on floating vessels and on offshore platforms.1/ Two types of minimum landing area design criteria were required by the sample ordinances, as shown in Figure 3. One type is based on the gross weight of the aircraft combined with specific geometric dimensions. The other is based on the use of the facility (public or private) and the size of the aircraft. The latter accounts for changes in the future size of helicopters. Special consideration is sometimes given to elevated heliports. Where rooftop facilities are permitted, building and fire code, and safety restrictions are not uniform. However, some ordinances rely on standards prepared by the National Fire Protection Association, Inc.2/
Location	Locational considerations are an important standard in most ordinances, and are usually backed by quantitative measures which exhibit wide variations. For example, required distances of a heliport from non-compatible (i.e., residential) uses ranged from 250 to 2,000 feet. In California, all schools within 1,000 feet of a proposed facility, and all public utility companies and broadcasting companies in the area must be notified and any objections resolved. Some cities control location as a matter of policy, rather than law. These policies are usually related to safety considerations, especially approach-departure paths. In New York

1/Offshore Heliport Design Guide, Office of Aviation and Public Transportation, Louisana Department of Transportation and Development, March 1980.

2/Standard on Roof-Top Heliport Construction and Protection, National Fire Protection Association, Inc., NFPA 418, May 1979.

FIGURE 3

HELICOPTER MINIMUM LANDING AREA CRITERIA

Facility Classification	Criteria Based on Aircraft Weight Standard		Criteria Based on Facility Use/Aircraft Size Standard	
	Gross Weight	Minimum Landing Area		
Class I	Up to 6,000 lbs.	Ground level: 75 feet x 75 feet Elevated: 40 feet x 40 feet with additional 18 feet perimeter safety area.	Private (small)	1.5 times helicopter length, plus 1/4 helicopter length for perimeter safety area.
Class II	6,000 lbs. to 12,000 lbs.	Ground level: 100 feet x 100 feet Elevated: 50 feet x 50 feet with additional 25 feet perimeter safety area.	Private (large)	1.5 to 2.0 times helicopter length, plus 1/4 helicopter length for perimeter safety area.
Class III	12,500-15,000 lbs. to 20,000 lbs	Same as Class II	Public (large)	1.5 to 2.0 times helicopter length, plus 1/2 helicopter length for perimeter safety area

Source: Compiled by Sydec from ordinances collected from several cities.

City, helicopter facilities are approved along waterfront locations only to take advantage of the City's extensive network of river and harbor open space corridors. Other cities focus on specific distance and angle approach-departure alignments by type of facility, similar to the format shown in Figure 3. These standards vary considerably from area to area.

Hours of Operations

None of the large urban area ordinances, which are focused primarily on Central Business Districts, restrict hours of operation. However, in suburban areas with large dispersed residential neighborhoods, operating hours are likely to be curtailed by law. One suburban ordinance permitted helicopters to operate between 8AM and 6PM, Monday thru Friday only.

In dense urban areas, private heliport facilities' operating hours generally run from 7 AM to 7 PM weekdays, and from 9 AM to 6 PM on weekends. These hours normally do not apply to medical evacuation flights in emergencies, and landings based on prior appointment. Police and military planes are often provided round-the-clock emergency landing privileges.

Insurance

Ordinances either specify minimum amounts of liability and property damage insurance coverage (i.e., $100,000/person and $1 to 2.5 million/accident), or require verification of insurance coverage in amounts consistent with protecting the public welfare and safety.

Safety

Most safety standards, especially those for rooftop heliports and helistops are not included in the heliport ordinance, but can be found in separate sections of the municipal code, mainly building and fire codes. These codes are usually detailed and vary significantly from area to area.

Helicopter safety standards are sometimes formulated as administrative requirements by the lead agency responsible for review and approval of the permit. For example in Chicago, the ordinance permits rooftop heliports, but none have been constructed because the Fire Commissioner will not recommend issuing a license.

Environmental	None of the ordinances reviewed contained specific environmental standards for helicopters. Some specified that noise impacts must be considered in the permit approval process. However, many municipalities have separate noise ordinances, and some have comprehensive environmental quality review procedures, pursuant to state law. Helicopter provisions are being added to these noise and environmental codes in some areas, and already exist in others.

Conclusions and Recommendations

Many areas of all sizes are experiencing increased requests for helicopter facilities. The responsibility for regulating new heliports is shared by state and local (county or city) government, varies from state to state and is often not clear. Some large cities have independent regulatory control, while most smaller areas rely on zoning combined with a state permit procedure. Few comprehensive helicopter ordinances exist, and none of those reviewed cross all jursidictional boundaries within an urban area. The potential for numerous, conflicting ordinances and procedures is increasing. There is little consistency among ordinances in terms of major provisions, review and approval procedures and technical standards. Most ordinances are not linked to area ground/air transportation planning processes.

The above conclusions are based on a brief overview of a small sample of local ordinances. The major issues surrounding helicopter ordinances were identified, but are too broad and complicated to be investigated further within the scope of this study. If the potential benefits of helicopter and fixed wing commuter air facilities and services are to be realized in the future, clear guidelines should be developed concerning:

- What level of Government (state, metropolitan, county, city, town) should be responsible for heliport regulation and how should commonality among different jurisdictions be achieved?
- What type of regulation, if any, is appropriate, when, and where?
- What are reasonable provisions and technical standards for local ordinances which will not preclude technological advances?

- How can transportation planning and the regulatory process be coordinated at the local level?

It is recommended that these guidelines be developed and implemented through a cooperative effort of government and the private sector, planners and operators:

- FAA should look into the dimensions and implications of these issues at the national level and provide guidance to states.
- States should streamline their own procedures and take action to prevent the proliferation of conflicting ordinances by each municipality. This might take the form of procedural and technical guidelines, or legislation.
- MPOs, in cooperation with state, city and county government should inventory all existing ordinances and develop proposals for reconciling these ordinances with ground and air transportation plans.
- The aircraft industry and operators should actively participate in determining the need for, and content of, state and local heliport regulation, especially in terms of technical advice and experience.
- NASA can play an important role by advancing technological priorities that will help to diminish the need for local ordinances for both helicopters and fixed wing commuter aircraft, especially in the areas of noise, safety and operating performance.

APPENDIX A: SURVEY DESIGN

Designing the Questionnaire

In designing the questionnaire, a number of considerations had to be included. Because of the large number of questions to be asked, a short answer format was deemed most appropriate. In order to encourage respondents to think about each answer, numerous choices were presented, along with ample space for adding choices and writing in comments, explanations and the like. An important part of the survey process was relating the responses to the respondent's experience in rotorcraft and/or commuter air transportation, type of agency or firm, type of community or region where he or she works, any geographic constraints, and region of the country where located. The first part of the questionnaire incorporated a number of questions on these subjects. The last part of the questionnaire asked the respondent for recommendations for researchers, manufacturers and operators, and for any other comments or suggestions.

In additon, an important part of the survey was to determine the relative importance of various issues to each respondent. This was done by asking for a numerical rating of each question asked, ranging from "not important" to "very important" (-1 to +2). In this way, information could be gathered concerning the areas of interest and importance. On certain questions, separate answers were requested for rotorcraft and for commuter air, with separate columns of check-boxes provided.

The preliminary questionnaire was reviewed by the project Steering Committee, including representatives from NASA, APA, HAI, Vitro, Sydec, as well as other outside consultants. A sample questionnaire appears in Appendix B.

Selecting Survey Respondents

Initially, a list of FAA planning grant projects was obtained, and this yielded the names of local agencies (state, regional, etc.) which had been involved in airport planning under the FAA program. FAA officials at the various regional offices were contacted, and were helpful in producing names of individuals in the various local agencies who were involved in the planning projects. In addition, the FAA's National Planning Division was instrumental in getting officials in the regional offices to participate in the survey.

During conversations with the various local and regional planners, it became obvious that only a small percentage actually had experience in rotorcraft or commuter air, and in many cases, these individuals had only sat on steering committees and referred the questionnaire to consulting firms who had actually done the planning and design. These firms were then contacted.

In addition, the departments of transportation of each state were contacted. In many instances, states have a separate department of aviation, or often a division within DOT. Several respondents were obtained from this search.

Another important source of planners was the APA. A number of members who have had experience in air transportation were contacted and several completed questionnaires. NASA and HAI also provided names of planners, and other sources included membership lists of Transportation Research Board committees on aviation planning.

During the later stages of the survey process, an attempt was made to find planners from geographic areas which were not well represented, and similarly an attempt was made to get an adequate representation from various size cities and types of agencies. Eventually, some sixty-five or seventy planners with experience in rotorcraft and/or commuter air planning were located, and fifty-five actually completed the survey.

The Survey Process

The survey process was a combination of telephone interviews and the mail-back questionnaire. After a respondent was selected, he or she was told that the questionnaire would be forthcoming by mail and should be read thoroughly to prepare responses and to formulate any questions concerning the format or content. The respondent was then called and the questionnaire discussed.

It was stressed that the respondent should only answer those questions dealing with areas within his or her expertise, and should leave blank the remaining questions. Respondents were asked to rate the questions based on their importance to the type of work the respondent is involved with.

Some specific questions and issues were discussed over the phone and then the respondent completed the questionnaire and mailed it back. In some instances, respondents were called after the questionnaires were received in order to discuss a particular question or issue in further detail. In many cases, the comments and expanded answers were quite valuable in addition to the basic answers. Also, respondents were asked to send any reports or documents pertaining to the subject matter of the Project, and a great deal of very useful information was obtained in this way.

Analysis of the Survey

The fifty-five surveys were coded and keypunched onto computer cards. Descriptive questions dealing with job description, geographic location and constraints, years of rotorcraft, and commuter air planning experience, etc., were given numerical codes, as well as the check-boxes. Expanded answers, comments and recommendations for researchers, manufacturers and operators were analyzed manually. In all

a total of 366 responses were quantitatively analyzed.

Each response was analyzed in terms of absolute frequency of response and percentage frequency, relative to the sample of fifty-five questionnaires. Some responses were further analyzed as functions of other responses. For example, a number of questions were analyzed as a function of each response to the question of city size, so that an evaluation could be made of whether responses to those questions differed for small or large cities. Other questions were cross-tabulated with responses to questions on geographic location, type of agency of the respondent, amount of rotorcraft experience of the respondent, etc. For answers with numerical or percentage values, mean responses were calculated, as well as frequency of several ranges of values.

Due to small sample size, no attempt was made to analyze results in terms of statistical significance of differences.

APPENDIX B:

QUESTIONNAIRE AND RESPONSE DATA

The full questionnaire is reproduced on the following pages. The questions fall into the following six categories:

GROUP A: Respondent's Experience and Perspective

GROUP B: Transportation Missions (purposes for which aircraft are used or will be used)

GROUP C: Transportation Planning

GROUP D: Aircraft Characteristics

GROUP E: Impacts

GROUP F: Recommendations (for researchers, manufacturers and operators)

Tabulations are also provided on the questionnaire of the percentage of respondents selecting each response where multiple choice responses are provided (i.e., for groups C, D and E), along with other information summarizing the responses to these questions. Summaries of responses to group A, B and F questions are provided in the text of Chapter III.

GROUP A

RESPONDENT'S EXPERIENCE AND PERSPECTIVE

1. Your Name: Date:

2. Agency/Company: Address:

3. Planning Area/Region/Community: (summary on p. 16)

4. a) How would you categorize your planning area/region/community? (large city, small city, surburban, rural) (summary on p. 17)

   b) Are there any special geographic constraints affecting your planning area? (mountains, desert, etc.)

no constraint	58%
mountains	21%
lakes, oceans	17%
other	4%

5. What are your current position, title and responsiblities?

high level of responsibility	43%
middle level of responsibility	55%
low level of responsibility	2%

6. How many years of planning experience do you have?

0-5 yrs	13%	
6-15 yrs	60%	mean=12 yrs
16 or more	27%	

7. How much of your experience has been related to your present planning area/region/community?

0-32%	6%	
33-66%	17%	mean=82%
67-100%	77%	

8. What percentage of your experience has been related to air transportation?

0-32%	30%	
33-66%	17%	mean=63%
67-100%	53%	

9. Of your air transportation experience (answer to 8), what percentage has been related to rotorcraft? commuter air?

Rotorcraft			Commuter		
0-32%	90%		0-32%	79%	
33%-66%	4%	mean=14%	33-66%	10%	mean=21%
67%-100%	6%		67-100%	11%	

10. Has your rotorcraft/commuter air experience been related to your present planning area/region/community?

yes	94%
no	6%

11. What do you perceive as the need and potential roles for rotorcraft and commuter air transportation? (Types of markets, types of service such as police and fire, construction. business and corporate transportation, etc.).

12. What are the biggest problems facing planner concerned with rotorcraft/commuter air planning?

GROUP B

TRANSPORTATION MISSIONS

1a. Which missions are presently important and served by rotorcraft and commuter air (or short-haul fixed-wing) vehicles?

1b. Which will become more important over the next 10 years?

	ROTORCRAFT		FIXED-WING	
	1980	1990	1980	1990
- public transportation	29%	47%	73%	76%
- public service (police, fire, rescue, etc.)	89%	93%	9%	16%
- business/corporate	60%	75%	76%	76%
- cargo	24%	33%	38%	51%
- construction	58%	64%	5%	7%
- energy exploration	49%	60%	16%	18%
- forestry	33%	44%	11%	7%
- other (specify)	24%	25%	7%	9%

(Percent responding out of sample of 55)

NOTE: Please indicate in subsequent sections of this survey where answers vary substantially by type of mission, and by rotorcraft vs. fixed-wing craft.

GROUP C*

ORIGINAL PAGE IS OF POOR QUALITY

TRANSPORTATION PLANNING

Question	Issue	How Important is this Issue to You? (+2, +1, 0, -1)	Other Comments

PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR ROTORCRAFT VS. COMMUTER AIR, AND FOR DIFFERENT "MISSIONS" (passenger, cargo, corporate, construction, etc.).

NOTE: -1 = inappropriate
0 = not very important
+1 = somewhat important
+2 = very important

I. NEEDS AND MARKET

1. What types of planning data are important to you for determining the need for rotorcraft/commuter air services? (Check the important ones)

Issue: Determining need for rotorcraft/commuter air services

Rating: 1.7 (51)

	Rotor.	Comm.
- origin destination data	☐ 93%	☐ 81%
- travel patterns	☐ 73%	☐ 67%
- modal split	☐ 67%	☐ 59%
- CAB service segment data	☐ 34%	☐ 34%
- other: (specify) _____	☐ 40%	☐ 36%

Need data on user income, modal choice decision factors (time, cost, availability, accessibility, reliability, etc.) Need to identify communities in need of commuter air service and which can support such service. Must be able to quantify benefits and costs of helicopter and commuter air service. Need cargo data too.

2. Does adequate planning data exist and is it [illegible]?
Rotorcraft: 14% yes, 86% no
Commuter: 17% yes, 83% no

Issue: Adequacy and availability of data

Rating: 1.5 (42)

Data on aircraft movements is available, but not on the users and potential (latent) demand. Most rotorcraft operations are private.

3. What data are important in helping planners define market areas and potential user groups?

Issue: Defining market areas, user groups

Rating: 1.3 (48)

Need demographic data, income, travel habits, etc. Need info on price elasticity. Lack of service stability hurts market growth efforts. No freight info available.

- market surveys	☐ 86%
- commodity traffic studies	☐ 54%
- other _____	☐ 39%

4. Other questions and issues (specify) _____ ☐ 100%

(Specify) _____

Rating: 1.5 (14)

Need info on terminal facilities required. Political issues (pressure and opposition from environmentalists, etc.) are a major concern.

History of past service between two points. Types of aircraft to be used.

II. EXISTING TRANSPORTATION

1. What data on existing ground transportation are important to you concerning competing services and ground access to rotorcraft/commuter air facilities?

Issue: Ground transportation: access and competing services

Rating: 1.3 (50)

	Competing	Ground Access
- modes, routes, vehicles	☐ 71%	☐ 72%
- travel time, speed, congestion	☐ 70%	☐ 72%
- travel costs	☐ 85%	☐ 60%
- operating agencies	☐ 39%	☐ 33%
- facility location	☐ 50%	☐ 50%
- other _____	☐ 8%	☐ 8%

Availability of auto necessitates airports and heliports to be very accessible, or people will make their trips by car, for distances up to a few hundred miles. People do not like waiting time, especially at airports; thus schedule frequency is important as well as in-flight time. Comparative fuel costs are important.

* The numbers appearing in the large (rating) boxes represent the arithmetic mean response of those who answered the questions. The numbers in parentheses to the right of the boxes are the numbers of respondents answering the questions. The number appearing next to each check box is the percentage of respondents who checked the box, of those who answered the question. A summary of comments and conclusions appear to the right of the rating box for each question.

GROUP C (CONTINUED)

TRANSPORTATION PLANNING

Question	Issue	How Important Is This Issue to You? (+2,+1,0,-1)	Other Comments

PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR ROTORCRAFT VS. COMMUTER AIR, AND FOR DIFFERENT "MISSIONS" (passenger, cargo, corporate, construction, etc.).

2. What data are needed on air traffic congestion?

Air traffic congestion

	Rotor.	Comm.
- allocation of air space	☐ 68%	☐ 56%
- flight frequency	☐ 66%	☐ 58%
- landing patterns	☐ 60%	☐ 52%
- air traffic control (terminal)	☐ 52%	☐ 41%
- curfews	☐ 29%	☐ 21%
- delays and causes	☐ 37%	☐ 31%
- other _____	☐ 9%	☐ 9%

1.2 (53)

Some respondents feel that there are too many helicopter operations over large cities, congesting the air space. Should adopt Navy procedures for all-weather rotorcraft operations. Restricted military air space. Limited air space thru mountain passes.

3. What information is needed for rotorcraft and fixed-wing commuter aircraft relative to other modes?

System information

	Rotor.	Comm.
- door-to-door trip times	☐ 74%	☐ 60%
- cost to pass'g (shippers)	☐ 74%	☐ 54%
- cost to operators, subsidies	☐ 62%	☐ 45%
- fuel costs	☐ 68%	☐ 48%
- system costs (infra-structure construction, maintenance)	☐ 68%	☐ 54%
- other (specify) _____	☐ 11%	☐ 5%

1.2 (37)

Relative location and accessibility of various modes is an important factor. Overall operating costs are needed to determine competitiveness with other modes.

4. How do planners assess the value of time as a benefit for passengers? _____

Value of time

1.0 (33)

Time assessed at wage rate for work related trips; less for pleasure trips. Waiting time at airports is very important in mode choice decision-making.

5. Other questions and issues (specify) _____

(Specify) _____

1.2 (10)

How airports must qualify as essential air service to receive subsidies. Develop cost/benefit analysis for rotorcraft and commuter air. In remote areas, frequency of flights is more important than travel time.

III. AIRPORT/HELIPORT CONFIGURATION, LOCATION, OPERATIONS

1. What criteria are important in determining heliport/airport location?

Airport/Heliport location

	Heliport	Airport
- distance from CBD	☐ 89%	☐ 77%
- cost of construction	☐ 66%	☐ 72%
- ground access	☐ 97%	☐ 85%
- air space	☐ 70%	☐ 68%
- safety	☐ 93%	☐ 79%
- proximity to users	☐ 85%	☐ 70%
- space requirements	☐ 68%	☐ 68%
- other locational requirements	☐ 50%	☐ 39%
- noise	☐ 79%	☐ 77%
- other environmental	☐ 50%	☐ 54%
- proximity to schools, hospitals, parks	☐ 60%	☐ 56%
- other (specify) _____	☐ 22%	☐ 22%

1.8 (50)

Obstructions (tall buildings, utility towers, mountains, etc.) help determine location. Accessibility to users, and an environmentally acceptable site are also prime determinants. Community exposure, zoning, environmental regulations, etc. are important.

GROUP C (CONT'D)

TRANSPORTATION PLANNING

Question	Issue	How Important Is This Issue to You? (+2,+1,0,-1)	Other Comments

PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR ROTORCRAFT VS. COMMUTER AIR, AND FOR DIFFERENT "MISSIONS" (passenger, cargo, corporate, construction, etc.).

2. Which factors are important in determining heliport/airport configuration?

	heliport	airport
- cost	☐ 65%	☐ 71%
- dimensions	☐ 65%	☐ 68%
- approvals (CAB, local)	☐ 87%	☐ 47%
- noise	☐ 68%	☐ 65%
- refueling, maintenance	☐ 28%	☐ 26%
- passenger comfort	☐ 28%	☐ 31%
- other (specify) _____	☐ 15%	☐ 15%

Heliport/airport configuration — 1.1 (40)

Higher elevations necessitate longer runways. Safety considerations and ground support facilities are decision areas of configuration.

3. What information is needed to determine whether ownership and/or operations should be public or private?

- available funding and financing ☐ 78%
- administrative/legal ☐ 58%
- other _____ ☐ 25%

Public vs. private ownership/operations — 0.9 (53)

Location relative to other airports and competing modes should be considered. Also, public operation makes site acquisition and protection (zoning) easier. Need to promote a public purpose for new public facilities. Some planners feel that public agencies are not capable of providing adequate service.

4. What legal and regulatory information is needed for rotorcraft/commuter air planning?

- zoning, eminent domain ☐ 80%
- environmental reg's ☐ 72%
- landing fees ☐ 21%
- jurisdictional authority ☐ 72%
- curfews ☐ 29%
- regulatory authority ☐ 60%
- air space allocation ☐ 39%
- other (specify) ☐ 3%

Legal/regulatory — 1.3 (53)

Planners and officials must work together to develop meaningful regulations, requirements, etc. Legislation may want to establish some economic criteria before allowing new service (prevent marginal operations likely to fail).

5. How complicated and involved is the process of obtaining approvals and authorizations for heliports and airports?

Approvals and authorization — 1.3 (37)

Process is not complicated, but overcoming public opposition is more of a problem. Preparing EIS's is time consuming.

(heliports) mean = 1.8 (where not too complicated = 1.0, somewhat complicated = 2.0, very
(airports) mean = 2.0 complicated = 3.0.

6. Other questions and issues
- _____

(Specify) _____ 1.0 (2)

Need projections on future helicopter growth - include in Aviation System Plans.

Commuters become dependent on private operations and airports. Then land owner may decide to cease operation, or change land use.

GROUP D

AIRCRAFT CHARACTERISTICS

Question	Issue	How Important Is This Issue to You? (+2,+1,0,-1)	Other Comments

PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR AUTOGIRO VS. COMMUTER AIR, AND FOR DIFFERENT "MISSIONS" (passenger, cargo, corporate, construction, etc.)

E. ENVIRONMENTAL

1. Which noise level parameters are most useful to planners?

Noise parameters

- dBA ☐ 39%
- Ldn ☐ 74%
- EPNdB ☐ 17%
- CNR ☐ 1%
- NEF ☐ 19%
- other _____ ☐ 17%

1.5 (53)

Ldn is accepted by FAA and EPA. Most noise data on helicopter - generated noise levels and propagation. California requires CNEL.

2. Which criteria are most important in evaluating vehicle interior noise levels?

Interior noise

- maximum levels ☐ 33%
- average levels ☐ 38%
- pass-minutes of exposure ☐ 21%
- other (specify) _____ ☐ 2%

0.3 (44)

Vibration is equally important as noise to passengers.

3. What type of data are needed to evaluate far-field (community) noise?

Far-field noise

- maximum levels ☐ 60%
- number of occurrences ☐ 78%
- noise contour/land use maps ☐ 86%
- other _____ ☐ 18%

1.5 (52)

Data on background (ambient) levels during various time periods is needed. Also, number of people exposed is important. Need research on human response to helicopter noise.

4. What types of air pollution data are needed?

Air pollution

- type of emissions ☐ 71%
- emission rates ☐ 69%
- dispersion ☐ 61%
- other _____ ☐ 6%

0.7 (51)

Not a major problem except in containment areas. Dispersion modeling techniques are inadequate.

5. What information is needed on down-wash from rotorcraft?

Down-wash

- outflow velocity ☐ 29%
- particulate ☐ 20%
- wind velocity ☐ 29%
- other (specify) _____ ☐ 0%

0.2 (35)

Some importance for design of surrounding ground support facilities. Test operations on gravel areas may cause damage to parked aircraft.

6. What type of water pollution data are needed?

Water pollution

- run-off from airport/heliport ☐ 80%
- sewage, effluents ☐ 56%
- other _____ ☐ 10%

0.7 (48)

May be important in agricultural areas. Need info on fuel spill frequency.

GROUP D (CONTINUED)

AIRCRAFT CHARACTERISTICS

Question	Issue	How Important is This Issue to You? (+3, +2, +1)	Other Comments

PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR ROTORCRAFT VS. COMMUTER AIR, AND FOR DIFFERENT "MISSIONS" (passenger, cargo, corporate, construction, etc.).

7. How can impacts of community intrusion of airports/heliports and flightpaths be measured?

Community intrusion

- changes in land values ☐ 54%
- changes in property sales ☐ 49%
- complaints ☐ 78%
- other _____ ☐ 21%

1.3 (53)

Can study zoning changes, building permits, changes in land usage also. Installation of acoustical insulation in existing buildings, etc.

8. What passenger comfort/amenities (other than noise levels) require quantification?

Comfort/amenities

	Rotor.	Comm.
- vibration	☐ 48%	☐ 26%
- on-time/weather reliability	☐ 70%	☐ 41%
- space per passenger	☐ 39%	☐ 29%
- toilets	☐ 17%	☐ 14%
- seating comfort.	☐ 39%	☐ 34%
- cabin temp., pressure	☐ 26%	☐ 29%
- other _____	☐ 17%	☐ 14%

0.6 (42)

Most common and ability people's fears of flying in small aircraft. Comfort levels must be improved to encourage riders.

9. Other questions and issues

- _____ ☐100% (Specify) _____

1.5 (2)

Instrument flight capability is important to allow all-weather operations.

II. SAFETY

1. What type of safety data are important to you as a planner?

Safety statistics

- accidents per flight ☐ 46%
- accidents per veh-mi ☐ 40%
- accidents per pass-mi ☐ 51%
- accidents including innocent bystanders ☐ 38%
- fatalities per accident ☐ 10%
- fatalities to bystanders (not crew or pass's) per flight or veh-mi. ☐ 42%
- incidents (near-accidents) ☐ 26%
- other (specify) _____ ☐ 32%

1.0 (51)

Design standards are independent of actual safety data. Public is concerned with safety, especially near hospitals, schools, etc. Safety data is needed to educate public officials.

2. What aspects of safety are most important and/or need the most research and development?

Safety research

	rotor	fixed-wing
- engine failure	☐ 33%	☐ 17%
- rotor-blade failure	☐ 43%	☐ 5%
- navigational/landing systems	☐ 35%	☐ 41%
- weather-stability	☐ 41%	☐ 33%
- crew training; failures	☐ 33%	☐ 30%
- other _____	☐ 10%	☐ 2%

1.0 (41)

Airport approach (obstacles) and flight paths for reduced noise exposure must be studied relative to accident data.

3. Is there a major difference between the public's perception of safety and actual data?

Perceived vs. actual safety

-rotorcraft 72% yes, 28% no
-commuter air 70% yes, 30% no

1.1 (36)

This is true of officials and decision-makers as well as the general public. Press likes to highlight air crashes.

GROUP D (CONTINUED)

AIRCRAFT CHARACTERISTICS

Question	Issue	How Important Is This Issue to You? (+2,+1,0,-1)	Other Comments

PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR ROTORCRAFT VS. COMMUTER AIR, AND FOR DIFFERENT "MISSIONS" (passenger, cargo, corporate, construction, etc.).

4. Other questions and issues - _____ ☐100% (Specify) _____ — 1.8 (4) — Research on navigational aids and landing site development.

III. ECONOMICS/FUEL EFFICIENCY/MAINTAINABILITY/PRODUCTIVITY

1. From a planning perspective how important is purchase cost of the vehicle? mean = 2.2 (1.0 = not very, 2.0 = somewhat, 3.0 = very) — Purchase cost — 0.5 (35) — Useful in determining economic viability of new services.

2. How important is useful life of the vehicle? _____ — Useful life — 0.5 (36) — (same as above)

3. Which information on direct operating costs and revenues is important? — Direct operating cost — 0.7 (42) — A main issue is the economic feasibility of servicing a low density market. Info on taxes and license fees.

- crew size (and ground support personnel) ☐ 55%
- wages, productive time ☐ 45%
- fuel efficiency, cost ☐ 27%
- fares, cargo revenue ☐ 45%
- subsidies ☐ 32%
- other revenue ☐ 17%
- other _____ ☐ 7%

4. Which maintenance information is important? — Maintenance — 0.8 (36) — Maintenance is important from point of view of economic viability and also reliability of service (down-time of veh's) etc.

- miles between replacement of components ☐ 35%
- hours between replacement ☐ 52%
- overhaul schedules ☐ 47%
- time needed to make repairs ☐ 47%
- % flight availability ☐ 47%
- maintenance costs per task ☐ 41%
- other _____ ☐ 8%

5. Which information on indirect operating costs is important? — Indirect operating costs — 0.7 (33) — Only important to planners in assessing viability of new service.

- insurance costs, liability ☐ 70%
- taxes, fees, etc. ☐ 58%
- other _____ ☐ 12%

6. What measures of productivity and and passenger/cargo costs are important? — Productivity/passenger/cargo costs — 1.0 (38) — Measure cost of delay with dollars/minute.

	helic.	commut.
- $ / seat-mi or plane-mi	☐ 50%	☐ 44%
- $/ pass-mi. or ton-mi	☐ 69%	☐ 63%
- $ / ton-mi	☐ 30%	☐ 33%
- personnel per passenger/ton	☐ 16%	☐ 16%
- vehicle capacity, thru-put	☐ 38%	☐ 38%
- other _____	☐ 8%	☐ 8%

7. Other questions and issues - _____ ☐100% (Specify) _____ — 1.5 (2) — Research on improving cost effectiveness of new rotorcraft. Ability of veh's to change from passenger to cargo configuration, land on water, etc.

GROUP D (CONTINUED)

AIRCRAFT CHARACTERISTICS

Question	Issue	How Important Is This Issue to You? (+2,+1,0,-1)	Other Comments

PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR ROTORCRAFT VS. COMMUTER AIR, AND FOR DIFFERENT "MISSIONS" (passenger, cargo, corporate, construction, etc.).

IV. PERFORMANCE

1. What performance characteristics of the aircraft are important for planners? — Vehicle performance

	Rotor.	Comm.		
- runway lengths	☐ 0%	☐ 93%		
- acceleration, decel., climb, descent rates	☐ 47%	☐ 52%		
- maximum and cruising speeds	☐ 41%	☐ 33%		
- vehicle weight/seat (payload)	☐ 50%	☐ 45%		
- weather stability	☐ 58%	☐ 47%		
- navigational/ guidance systems	☐ 58%	☐ 58%		
- other _____	☐ 14%	☐ 12%	1.4	(50)

Engine failure flight capability is of concern. Performance is important to planners with respect to modal choice (time, comfort, reliability) etc.

2. Other questions and issues (Specify)

- _____	☐ 100%	1.0	(3)

Equipment reliability, failure rates. Planners need info on future aircraft.

GROUP B

IMPACTS

Question (PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR ROTORCRAFT VS. COMMUTER AIR)	Issue	How Important Is This Issue to You? (+2,+1,0,-1)	Other Comments

I. ECONOMIC

1. Which service factors are most important to you as a planner?

Transportation Service Factors — 1.5 (53)

	helic.	comm.
- potential door-to-door trip cost and time savings	☐60%	☐52%
- linking communities via transportation	☐49%	☐64%
- increased productivity (passenger/cargo per acre) of land	☐23%	☐11%
- reducing ground and air traffic congestion	☐45%	☐39%
- inter-modal connections	☐64%	☐52%
- safety benefits	☐23%	☐27%
- other _____	☐ 1%	☐ 3%

In remote areas, air transportation is vital link for food, medicine, etc.

2. Which of the following do you feel are important potential effects on the industrial base of communities from rotorcraft/commuter air transportation?

Effects on Industry Base — 1.2 (45)

	rotor.	comm.
- decentralization of manufacturing	☐ 48%	☐ 25%
- centralization of corporate management	☐ 44%	☐ 16%
- reducing energy consumption in construction activities and operating ground facilities and supporting infrastructure	☐ 32%	☐ 9%
- improved tax base	☐ 34%	☐ 23%
- inducement to new industries	☐ 51%	☐ 30%
- other _____	☐ 11%	☐ 11%

Good transportation accessibility is a key in industry locational choice. Need data on corporate use by industry segment. Commuter service can be used to build up line haul demand. Effects of commuter fair most in small communities.

II. QUALITY OF LIFE/ENVIRONMENT

1. What are the best ways of quantifying potential improvements to police, fire, disaster control, and rescue services through use of helicopters?

Improved police, fire, disaster control, rescue services — 1.0 (46)

- lives saved per $	☐ 45%
- crime reduction per $	☐ 47%
- arrests per crime	☐ 20%
- response time	☐ 43%
- other _____	☐ 6%

Best measures are response time and lives saved, but hard to quantify.

2. What are the best ways of quantifying potential improvements to traffic and environmental monitoring?

Improved traffic and environmental monitoring — 0.6 (42)

- improved traffic flow	☐ 72%
- better traffic enforcement	☐ 35%
- emission reductions	☐ 32%
- other _____	☐ 5%

Drivers respond to radio broadcasts of traffic conditions and take alternate routes.

GROUP E (CONTINUED)

IMPACTS

Question	Issue	How Important Is This Issue to You? (+2,+10,-1)	Other Comments

PLEASE INDICATE WHERE YOUR RESPONSES WOULD BE DIFFERENT FOR ROTORCRAFT VS. COMMUTER AIR, AND FOR DIFFERENT "MISSIONS" (passenger, cargo, corporate, construction, etc.).

3. What are the potential missions in which rotorcraft/commuter air services can reduce fuel consumption?

Reduced fuel consumption — 1.0 (45)

	helic	commut
- short haul commuter flights (smaller vehicles)	☐ 30%	☐ 65%
- airport-airport connections	☐ 34%	☐ 16%
- air taxi (urban)	☐ 30%	☐ 16%
- feeder to large hub airports	☐ 30%	☐ 41%
- specialized business and construction activities	☐ 58%	☐ 13%
- corporate (plant-to-plant)	☐ 23%	☐ 18%
- other _____	☐ 9%	☐ 4%

Much more data is needed for determination of fuel savings. Total fuel use may go up with induced new trip-making for new services.

4. What are the best ways of quantifying environmental impact of rotorcraft/commuter air operations, compared to other modes, for:

Environmental impact — 1.4 (45)

- noise _____	83%
- air pollution _____	25%
- community intrusion _____	67%
- other (specify) _____	13%

Number of people exposed or impacted is an important part of quantification. Need peak concentration at selected sites. Heliports can reduce need for airport expansions.

5. What are the best ways of measuring the impact of accidents on the community?

Impacts of accidents on community — 0.8 (44)

- property damage _____	44%
- lives lost _____	55%
- insurance costs _____	30%
- community concern, reduced business _____	25%
- other _____	6%

Can use values of claims, insurance data, actuarial data. Amount of media coverage is one measure.

6. What potential benefits are there to elderly/handicapped passengers from rotorcraft/commuter air transportation?

Elderly/handicapped — 0.6 (40)

- increased mobility _____	31%
- emergency health service _____	92%
- other _____	7%
- other _____	

Best measure is improvement in response time for emergency medical care. Small aircraft hard to board for elderly/handicapped.

7. Other questions and issues

(Specify) _____ — - (0)

- _____

GROUP F
RECOMMENDATIONS

PLEASE LIST RECOMMENDATIONS YOU HAVE FOR ISSUES WHICH SHOULD BE ADDRESSED BY RESEARCHERS, MANUFACTURERS, AND OPERATORS, FROM YOUR PLANNING PERSPECTIVE.

1. **What recommendations do you have for researchers related to rotorcraft/ commuter air?**

2. **What recommendations do you have for manufacturers related to rotorcraft/ commuter air?**

3. **What recommendations do you have for operators related to rotorcraft/ commuter air?**

(Responses summarized on pages 53, 54 and 55)

THE AMERICAN PLANNING ASSOCIATION TRANSPORTATION PLANNING DIVISION THANKS YOU FOR YOUR PARTICIPATION IN THIS SURVEY!

For further information about APA Transportation Planning Division's role in this study, please contact Willard L. Stockwell at(316) 268-4290.

APPENDIX C:

LIST OF SURVEY RESPONDENTS

Ackerman, T.M.
Airports Planning & Development Branch
Federal Aviation Administration (Southern Region)
Atlanta, GA 30320 Tele: (404) 526-7756

Attar, Andrew M.
Senior Aviation Planner
Port Authority of NY & NJ
New York, NY 10048 Tele: (202) 466-7869

Ball, Carl
Regional Planner
Federal Aviation Administration (Great Lakes Region)
Des Plaines, IL 60018 Tele: (312) 694-7313

Banning, Walker
Principal Planner, Environmental Management
Central New York Regional Planning Board
Syracuse, NY 13210 Tele: (315) 422-8276

Beisse, Mark
Federal Aviation Administration
Boeing Field
Seattle, WA 98108 Tele: (206) 767-2633

Bildilli, James V.
Chief Planner and Programming
Division of Aeronautics, Bureau of Aviation Safety
Illinois Dept. of Transportation
Springfield, IL 62706 Tele: (217) 753-4400

Bornemann, Geoff
Principal Planner
Capital District Regional Planning Commission
Troy, NY 12180 Tele: (518) 272-1414

Bragdan, Clifford
Assistant Dean, College of Architecture,
Professor of City Planning
Georgia Institute of Technology
Atlanta, GA 30332 Tele: (404) 894-3380

Brodesky, Robert
Aviation Planner
Denver Regional Council of Governments
Denver, CO 80211 Tele: (303) 455-1000

Cahill, Jr., Edward A.
Senior Planner
State of Alaska - Dept. of Transportation
Juneau, AK 99811 Tele: (907) 789-0841

Carstens, R.L.
Iowa State University
Ames, IA 50011 Tele: (515) 294-6777

Childriss, John T.
Transportation Coordinator
Governor's Office of Economic and Community Development
Charleston, WV 25305 Tele: (304) 348-4010

Civalier, Jr., Joseph
Head, Aviation and Rail Planning Unit
N.Y.S. Dept. of Transportation
Albany, NY 12232 Tele: (518) 457-1716

Costello, Raymond
Assistant Administrator (Planning)
Oregon Division of Aeronautics
Salem, OR 97310 Tele: (503) 378-4880

Curfman, Bruce A.
Senior Planner
Wichita - Sedgwick Co., Metropolitan Area
Planning Department
Witchita, KS 67202 Tele: (316) 268-4391

DeGraw, Harvey
Airport Planner
Federal Aviation Administratin (Eastern Region)
JFK Airport
Jamaica, NY 11430 Tele: (212) 995-3744

DerHohannesian, Armen
Director of Aviation Planning
Hoyle, Tanner & Associates, Inc.
Londonderry, NH 03053 Tele: (603) 669-5420

Dillon, Paul
Vice President
Mid-America Appraisal and Research Corp.
Chicago, IL 60601 Tele: (312) 368-1000

Garlow, Gary M.
Senior Vice President
Talbot, Cox & Associates, Inc.
Wilmington, NC 28406 Tele: (919) 762-5204

Gilworth, Lloyd
Airport System Planner
Federal Aviation Administration (Central Region)
Kansas City, MO 64106 Tele: (816) 374-5278

Glover, John
Supervising Transportation Planner
Port of Oakland
Oakland, CA 94607 Tele: (415) 444-3188

Gouge, Donald W.
Senior Transportation Planner
Fresno County Planning Dept.
Fresno, CA 93702 Tele: (209) 453-3896

Graham, John L.
Facilities Planner
City of Los Angeles Dept. of Airports
Los Angeles, CA 90009 Tele: (213) 646-5252

Harnish, Jim
Associate Planner
Sacramento Area Council of Governments
Sacramento, CA 95804 Tele: (916) 441-5930

Hartman, Richard
Transportation Planner
Houston-Galveston Area Council
Houston, TX 77027 Tele: (713) 6270-3200

Hopkins, Les
Senior Civil Engineer
Federal Aviation Administration (Northern California and Nevada)
Burlingame, CA 94010 Tele: (415- 876-2804

Kaplan, Margorie
Assistant Director, Transportation Planning
Southern California Association of Governments
Los Angeles, CA 90005 Tele: (213) 385-1000

Kunkel, Robert
Airport Operations Supervisor
Wisconsin Dept. of Transportation
(Bureau of Aeronautics)
Madison, WI 53707 Tele: (608) 266-2805

Lamberts, Henry A.
Acting Chief, Planning/Standards Branch
Federal Aviation Administration (Great Lakes Region)
Des Plaines, IL 60018 Tele: (312) 694-7388

LaVance, Helen
Senior Transportation Planner
Atlanta Regional Commission
Atlanta, GA 30043 Tele: (404) 656-7421

McElroy, Ellis R.
Civil Engineer, Airport Planner
Federal Aviation Administration (Alaskan Region)
Anchorage, AK 99513 Tele: (907) 271-5446

McGrath, Jr., Dorn C.
Professor & Chairman, Department of Urban & Region Planning
George Washington University
Washington, DC 20052 Tele: (202) 676-7475

Mitchell, Roger
Corporate Pilot & Vice President
International Coal Co., and Appalachian Helicopter
Pilots' Association
Lewisburg, WV 24901 Tele: (304) 645-6768

Moore, Duane
Chief Helicopter Pilot, Division of Aeronautics
Illinois Department of Transportation
Springfield, IL 62706 Tell: (217) 753-4400

Nelson, Dan F.
Aeronautical Planning Engineer
Utah Department of Transportation
Salt Lake City, UT 84111 Tele: (801) 533-5987

Nickolaisen, Cathy
Aviation Field Representative, Aeronautics Division
Arizona Department of Transportation
Phoenix, AZ 85007 Tele: (602) 261-7778

Paige, John H.
Senior Transportation Planner
Northeastern Illinois Planning Commission
Chicago, IL 60606 Tele: (312) 454-0400

Phraner, David
Director of Transportation Division
Tri-State Regional Planning Commission
New York, NY 10048 Tele: (212) 938-3353

Purdy, James
Senior Planner
Wallace, Floyd, Ellenzweig, Moore, Inc.
Cambridge, MA 02138 Tele: (617) 864-3500

Robart, Carl V.
Airport Planning Director
TRA Airport Consultants
Seattle, WA 98104 Tele: (206) 682-1133

Rodine, Richard L.
Chief of Planning, Airports Division
Federal Aviation Administration (Southwest Region)
Fort Worth, TX 76101 Tele: (817) 624-4911

Rodwell, Julie
Senior Associate
Simat, Helliesen & Eichner
Waldham, MA 02254 Tele: (617) 894-6214

Roxin, Charles
Senior Regional Planner
Genessee - Finger Lakes Region Planning Council
Rochester, NY 14608 Tele: (716) 546-5902

Ryan, Mark J.
Air Transportation Program Manager
Metropolitan Council
St. Paul, MN 55101 Tele: (612) 291-6359

Silvey, Nicholas
Chief Planner
Regional Planning Commission
New Orleans, LA 70130 Tele: (504) 568-6616

Speirs, Lee C.
Regional Avaiation Planner
State of Florida Department of Transportation
Tallahassee, FL 32304 Tele: (904) 488-4640

Sproles, Walton H.
Senior Airport Engineer
Talbert, Cox & Associates
Wilmington, NC 28406 Tele: (919) 762-5204

Thompson, John L.
Aviation Representative
State of Ohio Department of Transportation
Division of Aviation
Worthington, OH 43085 Tele: (614) 889-2533

Traill, Richard
Assistant Executive Director
Indianapolis Airport Authority
Indianapolis International Airport
Indianapolis, IN 46241 Tele: (317) 247-6271

Vermeeren, Eric
Airport Planner
Federal Aviation Administration (Western Region)
Airports Division
Los Angeles, CA 90009 Tele: (213) 536-6034

Wagner, Cecil C.
Programming Manager
Federal Aviation Administration (Rocky Mtn. Region)
Aurora, CO 80010 Tele: (303) 340-5554

Weedon, Jr., Parris
Airport Planning Officer
Federal Aviation Administration (New England Region)
Burlington, MA 01803 Tele: (617) 272-7231

Williams, Jon
Research Assistant
Metropolitan Washington Council of Governments
Washington, DC 20009 Tele: (202) 223-6800

Yokoyama, David
Airport Planning Engineer
Federal Aviation Administration Airports Division (Pacific-Asia Region)
Honolulu, HI 96850 Tele: (808) 546-7156

Zavattero, David A.
Transportation Planner
Chicago Area Transportation Study
Chicago, IL 60606 Tele: (312) 793-3464